



## Can calcium phosphate improve glass ionomer cements?

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0001

### **The potential and future of digital dentistry**

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In the last years a tremendous step forward in CAD/CAM was made and still a lot of new applications are in development. Main aspects have been the improvement of intraoral optical impression systems and the mostly full-automatic calculation and design of functional surfaces of restorations. This knowledge-based description of tooth morphologies, called the biogeneric tooth model, can be used for reconstructing the missing tooth surfaces suitable for the individual situation. The model was already introduced successfully for inlay/onlay and crown reconstructions and has now been extended to larger restorations. Additionally, new procedures to include the dynamic occlusion are possible avoiding interferences during jaw movements. In case of implantology and other fields of dentistry, software tools can assist in treatment planning and diagnostic problems. This lecture will give an update of actual software tools and their clinical applications and will provide a look into the future and potential of new developments.

0002

### **EVALUATION OF THE FRACTURE RESISTANCE OF CAD/CAM MONOLITHIC CROWNS THAT PREPARED WITH DIFFERENT CEMENT THICKNESSES**

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**Objectives** The purpose of this study was to evaluate the fracture resistance of monolithic CAD/CAM crowns that prepared with different cement thicknesses.

**Methods** A human maxillary premolar tooth selected for this investigation. Master model preparation was performed with a diamond bur under water spray. Impression from master die was taken to fabricate 105 epoxy resin replicas. The crowns were milled using a CEREC 4 CAD/CAM system.(Software Version, 4.2.0.57192) CAD/CAM crowns made with resin nanoceramic, feldspathic, lithium disilicate and leucite reinforced glass-ceramics. Each group subdivided into three groups in accordance with three different cement thicknesses (30, 90, 150  $\mu\text{m}$ ) (n=7). Then RelyX<sup>TM</sup> U200 was used as a luting agent to bond the crowns to the prepared samples. One hour after cementations, the specimens were stored in water bath at 37 °C for 1 week prior to testing. Seven intact teeth were kept and tested as control group. A universal testing machine was used to assume the fracture resistance tests of all specimens. The compressive load was centered on the central groove of each crown, so that the load was applied to the triangular ridges of both facial and palatal cusps. The compressive load (N) required for fracture was recorded for each specimen. Fracture resistance data were statistically analyzed with one way ANOVA and two factor with interaction modelling tests ( $\alpha=0.001$ )

**Results** The highest mean fracture resistance value was recorded for IPS e.max CAD (1390.327 N), and the lowest value was recorded for IPS Empres CAD (787.988 N). There were statistically significant differences among the fracture resistance of CAD/CAM monolithic crowns ( $p<0.001$ ); however, it was observed that the effect of cement thicknesses on the fracture resistance was not statistically significant. ( $p>0.001$ )

**Conclusions** CAD/CAM monolithic crown materials influence fracture resistance. Cement thicknesses (30,90,150  $\mu\text{m}$ ) did not influence fracture resistance of CAD/CAM monolithic crowns.

0003

### **Clinical evaluation of chair-side fabricated molar partial zirconia-containing lithium-silicate (ZLS) crowns – first results**

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**Objectives** Zirconia-containing lithium silicate ceramics (ZLS) are a new material group, characterized by a high mechanical capacity and good optical properties. Up to now, data on the clinical performance of this type of restorations are missing. Based on this background, CAD/CAM-fabricated monolithic partial ZLS molar crowns were evaluated in a practice-based prospective study.

**Methods** Between October 2013 and April 2014, 34 patients (20 female/14 male, age at insertion: 50.1±15.5 years) were restored with 48 partial molar crowns. The monolithic restorations were fabricated chair-side (Cerec SW 4.2/Cerec MC XL) from a ZLS ceramic material (Celtra Duo, Dentsply DeTrey, Konstanz, Germany). The restorations were milled, polished without glazing, and finally adhesively cemented in the total-etch technique with a dual-curing composite material. Baseline, all teeth were vital and asymptomatic. The patients did not show any signs of craniomandibular dysfunctions or bruxism. Follow-up examinations were performed 6 resp. 12 months after insertion (observational period: 12.4 ± 1.0 months), the following modified USPHS parameters were evaluated: retention, color match, marginal discoloration, secondary caries, anatomic form, marginal adaptation, surface texture. Moreover, the parameters “time-dependent survival” (in situ criterion), and “success rates” (event-free restorations) were evaluated according to Kaplan-Meier.

**Results** At the 12 months follow-up examination, all restorations were in situ (survival rate: 100%). No masticatory problems or thermal sensitivity were reported. During the observational period, one clinical intervention was necessary (endodontic treatment) to maintain function. Material-induced technical complications (fractures) were not determined. The success rate (complication-free restoration) was 97.9%.

**Conclusions** Initially, chair-side fabricated ZLS crowns show a good clinical performance. However, for a final evaluation of this new material, clinical data from studies with a larger population and longer observational periods are required.

0004

### **Evaluation of potential CAD/CAM post-crown materials**

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**Objectives** Computer-aided design/computer-aided manufacturing (CAD/CAM) materials have recently been popular in the dental clinics, but information as to their fracture resistance compared to each other as post-crowns with different materials is lacking. The purpose of this study was to compare the fracture resistance of possible one-piece post-crown materials fabricated by CAD/CAM milling with sound teeth.

**Methods** Fifty freshly extracted non-carious human central incisor teeth were endodontically treated. The roots were then randomly divided into five groups according to the post systems: the control group was only filled with gutta percha. Monoblock post-crowns were fabricated with four different systems in the other groups: Yttrium tetragonal zirconia polycrystal (YTZ-P); lithium disilicate glass; resin-based nanocomposite (RNC); and polymer-infiltrated-ceramic-network (PICN). The post-crowns were cemented with resin cement and submitted to universal testing at a crosshead speed of 1.0 mm/min. Statistical analysis of the data was performed using one-way ANOVA and multiple comparison post hoc Tukey tests ( $\alpha = .05$ ).

**Results** One-way ANOVA revealed significant differences between the groups ( $P < .001$ ). The mean fracture load of YTZ-P (668.87 N) was higher than those of RNC (343.79 N) and PICN (348.78 N). There were no significant differences between lithium disilicate glass and YTZ-P.

**Conclusions** Post-crowns fabricated of different materials by a CAD/CAM system performed over average fracture strength bearded by natural anterior teeth.

0005

**Chair-side fabricated partial crowns made from zirconia-reinforced lithium-silicate (ZLS) ceramics – first results of a case series**

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<sup>4</sup>Georg-August-University

**Objectives** Zirconia-reinforced lithium silicate ceramics (ZLS) represent a new material group, characterized by a high mechanical capacity and good optical properties. Up to now, data on the clinical performance of this type of restorations are missing. Based on this background, CAD/CAM-fabricated monolithic ZLS partial crowns were evaluated in a university-based prospective case series.

**Methods** Between January 2014 and March 2014, 13 patients (5 female/8 male, age at insertion: 48.8±9.3 years) were restored with 9 premolar and 7 molar partial crowns. The monolithic restorations were fabricated chair-side (Cerec SW 4.2/Cerec MC XL) from a ZLS ceramic material (Vita Suprinity, Vita Zahnfabrik, Bad Saeckingen, Germany). The restorations were milled, polished, and glazed, finally adhesively cemented applying the total-etch technique with a dual-curing composite material (Variolink II, Ivoclar Vivadent, Schaan, Liechtenstein). At baseline, all teeth were vital and asymptomatic. The patients did not show any signs of craniomandibular dysfunctions or bruxism. Follow-up examinations were performed 6 resp. 12 months after insertion (observational period: 11.7 ± 0.8 months), the following modified USPHS parameters were evaluated: retention, color match, marginal discoloration, secondary caries, anatomic form, marginal adaptation, surface texture. Moreover, the parameters “time-dependent survival” (in situ criterion), and “success rates” (event-free restorations) were evaluated according to Kaplan-Meier.

**Results** At the 12 months follow-up examination, all restorations were in situ (survival rate: 100%). Minor thermal sensitivity was reported for two restorations. During the observational period, no clinical intervention was necessary to maintain function. Material-induced technical complications (fractures) were not determined. The success rate (complication-free restoration) was 100%.

**Conclusions** Initially, chair-side fabricated ZLS crowns investigated in this study show a good clinical performance. However, for a final evaluation of this new material, clinical data from studies with a larger population and longer observational periods are required.

0006

**Oral mucositis in recipients conditioned with oral busulphan for allogeneic hematopoietic stem cell transplantation.**

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**Objectives** Oral mucositis (OM) is a side effect of intensive chemotherapy and has been reported to affect 75–100 % of hematopoietic stem cell transplantation (HSCT) recipients. The purpose of this study was to compare the incidence and severity of OM in patients conditioned with oral busulphan (BU) administered in a four-dose regimen (BU4) of 4x1 mg/kg/day for 4 days and in two-dose regimen of 4x1 mg/kg/day for 2 days.

**Methods** The study involved 112 HSCT recipients, with hematological malignancies transplanted between 2007 and 2014 and conditioned with BU. Mean age of the patients was 49 years (range 11–72). Sixty (53 %) had BU2 and 52 BU4 regimen. Clinical features of OM were recorded from day –3 before up to day +25 after HSCT using the WHO scoring system.

**Results** Overall, 90 % of the patients developed OM of any severity, which peaked on day 10-11. The mean OM score was 1.8. BU4 conditioning was correlated with significantly higher total OM score (8.8 ±4.6) from day 9 to 12 compared to BU2 (5.4 ±3.9), (hazard ratio (HR) = 1.63, (95% CI) 1.33-2.01, p<0.001).

**Conclusions** The incidence and severity of oral mucositis was lower in patients conditioned with two-dose BU regimen. Further investigations on the relationship of other conditioning regimens on OM are needed.

0007

**Histo-pathophysiology of oral mucosa in patients with chronic graft versus host disease**

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**Objectives** Graft-versus-host disease (GVHD), a major complication of allogeneic hematopoietic stem cell transplantation, is classified as acute (aGVHD) or chronic (cGVHD). cGVHD manifests as an autoimmune-like disease affecting multiple sites. The oral cavity is commonly involved in 45-83% of cases that present with a diverse spectrum of clinical features, such as mucosal lesions, salivary gland dysfunction and restricted mouth opening present. Histological presentation of oral mucosal tissues resembles other autoimmune diseases, with strong proinflammatory processes but knowledge of the pathophysiological features are not well defined. We aimed to characterize the histo-pathophysiology of clinically-graded cGVHD (mild-severe) from oral buccal mucosa and to examine the magnitude and location of infiltration related to the clinical scoring.

**Methods** Oral mucosal biopsies from graded-cGVHD and healthy patients were stained for histology and a panel of inflammatory markers. Slides were digitalized and staining quantified.

**Results** Histological changes, such as flattening of rete ridges, thickened basement membrane and increased number of clear cells correlated with increasing severity. A significant increase ( $p > 0.05$ ) in inflammatory markers; CD4, CD8, CD68, CD19, CD20, CD5 and CD1a were observed with increasing clinical severity of cGVHD across all regions of the oral mucosa when compared to healthy tissue. Inflammation was concentrated to the papillary layer of the lamina propria.

**Conclusions** We report on the dynamic pathophysiological changes within cGVHD oral mucosal affected tissues related to the clinical-severity of the disease. This study points to the need for large cohort screening of oral mucosa tissues that will aid in the formulation of better clinical diagnoses of oral cGVHD.

0009

**Lymph vessels as a prognostic factor in tongue squamous cell carcinoma**

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**Objectives** Tongue squamous cell carcinoma has a poor prognosis and therefore new clinical biomarkers and therapeutics options are needed. A transmembrane sialoglycoprotein, Podoplanin (PDPN), is a lymphatic endothelial marker which has been found to be overexpressed in tumor cells of various cancers with involvement in tumor progression, invasion and metastasis. Many studies have revealed altered PDPN expression in various cancers including oral squamous cell carcinoma (OSCC) cells raising a possibility that PDPN may have potential role in carcinogenesis and cancer prognosis. The objective of this controlled study was to define the proportion of lymph vessels to all vessels, and its effect of patient surviving from tongue squamous cell carcinoma.

**Methods** The patient material consisted of 90 patients that have been treated in Tampere University Hospital due to tongue cancer (n=61) or lingual mucosal hyperplasia (n=29). In addition, regional lymph node specimens collected from 32 patients and 23 of these were metastatic. Altogether 113 samples were stained immunohistochemically with monoclonal antibody D2-40, which recognizes podoplanin, as well as with von Willebrand factor VIII, which recognizes all vessels. The number of vessels per square millimeter was assessed semiquantitatively in the light microscopic evaluation.

**Results** A high proportion of lymph vessels to all vessels were associated with inferior survival. Patients with the high proportion of lymph vessels ( $\geq 80\%$ ) to all vessels had inferior survival rate ( $p=0.003$ ) when comparing to patients with low proportion of lymph vessels ( $< 80\%$ ). Similar findings were detected when observing the subgroup without metastasis. In contrast, the proportion of lymph vessels did not affect the survival in the subgroup with metastasis.

**Conclusions** The proportion of the lymph vessels to all vessels might be useful in prediction of tongue squamous cell carcinoma.

0010

### **Microstructure of the Epithelial Cells of the Oral Mucosa After Radiotherapy**

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**Objectives** The microplicae structure (MPLs) is typical of the epithelial surface of the oral mucosa. The cell surface is of potentially great significance, as it harbours many markers for refined prognosis and targets for oral cancer therapy. Therefore, the aim of this study is to investigate whether radiation therapy affects the surface morphology of the superficial cells of the human oral mucosa with patients who have received radiation therapy for oral cancer. The results are described qualitatively and quantitatively.

**Methods** The sample tissues were collected from 54 patients during implant surgery; 11 patients have received radiation therapy for oral cancer, 11 oral cancer patients without radiotherapy and 32 healthy controls. The samples were studied with scanning electron microscopy (SEM) and quantitative pixel region analysis was made with the ImageJ image analysis software. The SEM micrographs were compared with transmission electron (TEM) micrographs.

**Results** Radiation therapy induces breakage and destruction in the morphology and declines the density of the MPL surface structures of superficial oral epithelial cells. From some of the radiated cells the MPL were completely vanished. However, radiation therapy surprisingly seems to affect the MPL structure and density less negatively than oral cancer itself.

**Conclusions** Radiation therapy causes decline in the frequency and degeneration of cell surface structures, but seems to improve the morphology of MPL in cancerous cells

0011

### **Randomized 30-Year Follow-up of Class II restorations of Three Resin Composites**

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**Objectives** To evaluate in a 30 year randomized controlled study the durability of Class II restorations made with three conventional resin composites.

**Methods** Each of 30 participants (mean age 30 yrs, range 20-44) received at least three (one set) as similar as possible Class II restorations. The three cavities were chosen at random to be restored with chemical-cured (P10, Miradapt) and light-cured resin composites (P30). A chemical-cured enamel bonding agent was applied after etching of the enamel. The chemical-cured resin composites were placed in bulk and the light-cured in increments. One operator placed 99 restorations (33 sets). The restorations were evaluated with modified USPHS criteria at baseline, 2, 3, 5, 10, 15, 20 and 30 years. Statistical analyses were performed by the Kaplan Meier, log-rank test and Cox regression analyses.

**Results** After 30 years, drop outs were 5 participants with 15 restorations (15%). Seven participants were considered as caries risk and eight participants as having active parafunctional habits. Postoperative sensitivity was observed in 24 teeth. In total 28 restorations, 9 P10, 12 P30 and 7 Miradapt restorations failed during the 30 years. The main reasons for failure were secondary caries (39.2%) and material fracture (35.7%). 64% of the secondary caries lesions were found in high caries risk participants and 70% of the material fractures occurred in participants with active parafunctional habits. The overall success rate at 30 years was 63%, with an annual failure rate of 1.1%. 68%-81% of the restorations showed non-acceptable color match. No statistical significant difference in survival rate was found between the three resin composites (p=0.45). Tooth type, cavity size, age, and gender of the participants did not significantly affect the probability of failure.

**Conclusions** The three conventional resin composites showed good clinical performance during the 30 year evaluation.

0012

### **Clinical evaluation of SonicFill restorations in Class II cavities up to 2 years**

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**Objectives** This clinical study evaluated the clinical performance of a bulkfill resin composite in Class II cavities up to 2 years.

**Methods** *Methods:* Between March-2013 and January-2014, a total of 52 patients (15 male, 37 female, mean age: 27.2±11 years old), received 111 direct Class II restorations in premolars and molars by two operators and were followed up until April 2015. After conditioning the tooth with one-step etch-and-dry adhesive system with selective etching technique, restorations were made using a bulk fill nano-hybrid resin composite (SonicFill, Kerr/Sybron) according to the manufacturer's instructions. Two independent calibrated operators evaluated the restorations 1 week after placement (baseline), at 6 months and thereafter annually up to 2 years using USPHS criteria for anatomic form, marginal adaptation, color match, surface roughness, marginal discoloration, secondary caries, post-operative sensitivity and gingival health. The changes in the USPHS parameters were analyzed using McNemar test (alpha= 0.05) and Kaplan-Meier.

**Results** Mean observation period was 17 months. No secondary caries were observed until the final recall. One restoration received endodontic treatment after 2 months following the restorative procedure and accepted as failure. The overall success rate was 99.1% at final recall (Kaplan-Meier). Color match deteriorated from Score 0 to Score 1 (good color match) in 8 restorations from baseline to 6 months and final recall (p=0.008). Six restorations showed marginal staining and received Score 1 (slight staining, can be polished away) at final recall (p=0.031).

**Conclusions** Bulkfill resin composite (SonicFill) showed acceptable clinical performance up to 2 years of service but colour match to tooth started showing deterioration already within the first 6 months.

0013

### **18-Months Clinical Comparison of Two Resin Composites on Diastema Closure**

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**Objectives** To evaluate and compare the clinical performances of two nano-hybrid resin composite systems used for anterior diastema closure at 18-months.

**Methods** Twenty-three patients with anterior midline or multi-diastema problem were enrolled in this study. Nano-hybrid resin composite systems to be used on each patient were randomly selected. Thirty seven teeth of 10 patients were restored with Filtek-Z550 (3M/ESPE) in combination with Adper™ Single Bond 2 (3M/ESPE) etch&rinse adhesive; whereas 39 teeth of 13 patients were restored with Charisma-Diamond (Heraeus Kulzer) in combination with Gluma2 Bond (Heraeus Kulzer) etch&rinse adhesive by two operators. Esthetic, Functional and Biological properties of the restorations were evaluated at baseline, 6-12 and 18-months using FDI Criteria establishing a score-range of 1-5 (1-Clinically excellent/very good, 2-Clinically good, 3-Clinically sufficient/satisfactory, 4-Clinically unsatisfactory and 5-Clinically poor) by two independent examiners. The data were evaluated using the Fisher's Chi-Square (p=0.05).

**Results** At 18-months, 58 restorations (19 patients) were evaluated. Two Charisma-Diamond restorations were repaired due to partial fracture (Score5). Eight Filtek-Z550 restorations and 8 Charisma-Diamond restorations exhibited minor surface/marginal staining (Score2). The surface luster of 3 Filtek-Z550 restorations and 6 Charisma-Diamond restorations were scored as 2. Five Filtek-Z550 restorations and 5 Charisma-Diamond restorations exhibited minor irregularities in marginal adaptation (Score2). However, there were no significant differences between two restorative materials for the criteria assessed (p>0.05). Patients having Filtek-Z550 restorations were satisfied (Score2) with their restorations, whereas all patients having Charisma-Diamond restorations declared that they were entirely satisfied with esthetics and function (Score1) (p<0.05). All the restorations in both groups were clinically excellent (Score 1) for the rest of the functional and biological properties assessed.

**Conclusions** Both nano-hybrid resin composite systems revealed esthetically, functionally and biologically good clinical performance when used for diastema closure at 18-months.

0014

## CLINICAL EVALUATION OF CLASS I RESTORATIONS WITH THREE DIFFERENT ADHESIVE STRATEGIES

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**Objectives** The aim of the present double-blinded clinical trial was to evaluate the 12-month clinical performance of dentin bonding agents with three different adhesive strategies in posterior Class I composite restorations.

**Methods** 188 restorations in forty three patients were assigned to three groups regarding the adhesive strategies used; three-step total etch system; Optibond FL (OBF), two-step self-etching system; Clearfil Protect Bond (CPB) and one-step self-etching system; iBond (IB) Following bonding agents application occlusal restorations were restored incrementally with composite resin materials of each manufacturer's according to the recommended instructions. The restorations were evaluated at baseline, 6 month and at 12 months, using United States Public Health Service (USPHS) criteria. Statistical analyses were performed using Friedman repeated-measures analysis of variance by rank and McNemar test for significance in each pair ( $\alpha=0.05$ ).

**Results** No loss of restorations were recorded during 12 months. Marginal discoloration was detected and scored bravo in %45 of the teeth restored with iBond whereas 4% and 3% with matched bravo for PBL and OPL respectively ( $p>0.05$ ). 85% of the teeth restored with CPB and 84 % with OBF were rated as alpha regarding the marginal adaptation whereas iBond resulted in a significantly higher incidence of bravo scores with 33% and 2 restorations with charlie scores using the USPHS criteria.

**Conclusions** Through the evaluation period, the clinical retention of the total-etch and self-etch dentin bonding systems applied in Class I posterior restorations was fully successful regardless of their different adhesive strategies. Within the limitation of the present study ,total-etch and two-step self-etch dentin bonding systems exhibited higher performance regarding the marginal adaptation and coloration which need to be evaluated for a longer period of clinical performance.

0015

## Clinical performance of fissure sealants placed with different adhesive systems

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**Objectives** To evaluate and compare the clinical retention of a resin-based fissure sealant placed with prior application of etch-and-rinse (ER) and self-etch (SE) adhesives.

**Methods** 204 sealants were placed in 51 children with previously unsealed, caries-free permanent first molars, employing a split-mouth design. The teeth were randomized into four groups (n= 51 teeth/group) according to the adhesive system placed under the tested resin-based sealant (Delton FS+; Dentsply). Group 1 (Control arm): No bonding agent (conventional acid-etch sealant), Group 2: Prior enamel etch + ER adhesive (XP-Bond; Dentsply), Group 3: SE adhesive-only (Clearfil-SE-Bond; Kuraray) without prior etching, Group 4: Prior enamel etch + SE adhesive (Clearfil-SE-Bond). Clinical assessments were performed according to modified USPHS criteria at 1, 3, 6, 12, 18 months. The data were analyzed statistically using Fisher's Exact test, Kaplan-Meier analysis and Log-rank test.

**Results** At 18 months, the conventional technique and SE-only group had similar cumulative survival rates (62% and 45%, respectively) for occlusal surfaces. XP-Bond and Clearfil-SE-Bond with prior etching showed similar (90% and 94%, respectively) and higher survival rates. The cumulative survival rates on palatal/buccal surfaces showed similar outcomes as with occlusal surfaces: XP-Bond (94%), Clearfil-SE-Bond + acid etch (96%), conventional sealant (54%) and Clearfil-SE-Bond-only (39%).

**Conclusions** With prior enamel etching, the etch-and-rinse and self-etch groups showed similar and significantly higher sealant retention rates. For the self-etch adhesive, prior enamel etching significantly increased sealant retention. The conventional technique outperformed the self-etch-only bonded sealants in the absence of statistical significance.



0016

### **Clinical Evaluation Of Reinforced Glass Ionomer Systems After 6 Years**

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**Objectives** The aim of this study was to evaluate the clinical performance of two reinforced glass ionomer cements after a period of 6 years.

**Methods** Fifty-four patients having Class I and II restorations/caries were included in the study. A total of 252 restorations were made with Equia (GC Corp, Japan) and Riva (SDI, Australia). G-coat Plus or GC varnish were used randomly on the surface of the restorations. Equia + G-coat Plus is presently called EquiaFil. After cavity preparations, the teeth were randomly restored with one glass ionomer cement and coated with G-coat Plus or GC Varnish. The restorations were evaluated at baseline, 6, 12, 18 months and 6 years after placement using modified USPHS criteria. Color-match, marginal discoloration, marginal adaptation, caries formation, anatomical form, postoperative sensitivity and retention rate were checked by two evaluators and photographs were taken at each recalls. The results were evaluated with Chi-Square ( $p < 0.05$ ).

**Results** 37 patients were evaluated. There was significant difference between EquiaFil and Riva regarding retention rate and color-match after 6 years ( $p=0,033$  and  $0,046$ ). When comparing baseline to 6 years, the overall success of EquiaFil was better than Riva having significant problems regarding retention rate and anatomical form ( $p=0,016$  and  $0,031$ ). Class II cavities were significantly worse in marginal adaptation, anatomical form and retention rate in Riva groups ( $p=0,033$ ,  $0,015$  and  $0,007$ ) but not in EquiaFil groups. The combination of the coatings had no effect on the overall success of the materials.

**Conclusions** EquiaFil system was more successful than Riva regarding color-match and retention rate after a 6-year clinical period. Despite minor reparable defects, the overall clinical performance of EquiaFil was excellent even in large posterior Class II restorations after a period of 6 years.

The materials of this study were generously donated by GC and SDI.

0017

### **Reconstructive Periodontal Therapy: A Holistic Approach**

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The major goal of periodontal therapy has been shifted from repair to reconstruction of periodontal tissues thereby reversing the damage to the periodontium caused by the disease process. The possibility of gaining periodontal support will improve the patient's function, comfort and aesthetics. The first evolutionary stage of periodontal regeneration focused on bone graft materials. Autogenic, allogenic, xenogenic and alloplastic bone graft materials have been used for regeneration purpose. Since these techniques have had limited success, other regenerative approaches have been suggested that utilize tissue-engineering techniques. This concept began with guided tissue regeneration (GTR). Treatment of intrabony defects with GTR has yielded successful clinical and histological results with nonresorbable and bioabsorbable membranes. However, the membrane may collapse into the defects and reduced amounts of bone can be formed due to the lack of space for progenitor cell population. Combined techniques have been an option in creating a space for the regenerating tissues underneath the membranes and suggest the use of additional properties of the graft materials. Advances in molecular biology set the ground for a new concept in periodontal regeneration by emphasizing the importance of biologic mediators. The discovery of the presence of the enamel matrix layer between the peripheral dentin and the developing cementum, periodontal ligament and alveolar bone, has provided the fundamental concept for enamel matrix protein derivative supported tissue engineering. Polypeptide growth factors are an enchanting group of agents as biologic mediators because of their regulatory effects on proliferation and differentiation of cells from bone and connective tissues. Platelet rich plasma/fibrin, with the content of these polypeptide growth factors, may contribute to periodontal regeneration. This lecture will focus on all the aforementioned technique sensitive approaches in clinical practice with the limiting factors that may contribute to inadequate clinical and biological outcomes.

0018

### **LED irradiation at 660nm stimulates human oral epithelial cell growth responses**

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**Objectives** The aim of this study was to determine beneficial biological responses in human oral epithelial cells irradiated by light-emitting diodes (LEDs). Mitochondrial metabolic activity and cell proliferation were evaluated in the response to LED irradiation utilising a range of wavelengths and doses (radiant exposures).

**Methods** A bespoke LED array consisting of 42 LEDs (24mW/cm<sup>2</sup>) with a range of wavelengths between 400-830nm (7 wavelengths, n=6) was used for light irradiation. Initial light characterisation determined the spectral irradiance and wavelength for each LED using a calibrated fibre-based spectrometer (USB4000, Ocean Optics). Human gingival epithelial cells (H400) were seeded (3000 cells/well) in DMEM (supplemented with 5% FCS) in black-walled, transparent based 96-well plates and incubated at 37°C in 5% CO<sub>2</sub>. Cultures were exposed to the bespoke LED array with doses between 0 and 11.6 J/cm<sup>2</sup> at 24h post-seeding. Cell number, mitochondrial metabolic activity (MTT assay) and DNA synthesis (BrdU assay) were determined 48h post-irradiation. Statistical analyses were performed using ANOVA and Tukey post-hoc tests (p<0.05).

**Results** Following LED irradiation at a wavelength of 660nm mitochondrial metabolic activity, cell proliferation and DNA synthesis were all significantly increased (p<0.05) and indicated that a radiant exposure of 11.6J/cm<sup>2</sup> (480s) gave the most effective biological response.

**Conclusions** This study indicates that LED exposure at a wavelength of 660nm may provide a potential therapeutic approach for enhancing healing of the gingival epithelium in periodontal disease. Further optimisation of the efficacy of irradiation parameters should be performed to identify the most appropriate conditions for therapeutic application.

0019

### **Manual Versus Powered Toothbrushing in Patients with Intellectual Disability**

García-Carrillo, A.<sup>2</sup>, Jover, A.<sup>1</sup>, Plá, R.<sup>1</sup>, Martorell-Cafranga, A.<sup>3</sup>, Gómez-Moreno, G.<sup>4</sup>, Sanz, M.<sup>1</sup>, Herrera, D.<sup>1</sup>

<sup>1</sup>University Complutense, <sup>2</sup>San Pablo CEU University, <sup>3</sup>Fundación Carmen Pardo-Valcarce, <sup>4</sup>University of Granada

**Objectives** To compare the supervised and unsupervised use of powered or manual toothbrush in patients with intellectual disability (ID) in terms of plaque and gingival indices and adverse effects.

**Methods** Subjects with ID were recruited for this randomised, single-blinded (examiner), 6-month clinical trial. Primary outcome variables were plaque (PII) and gingival (GI) indices, evaluated at baseline and 3 months after supervised manual or powered tooth brushing and then after 3 additional months of unsupervised used. Student t test, Mann-Whitney and Sign Rank tests, ANCOVA and Chi square test were used to evaluate statistically significant differences.

**Results** 64 patients (34 male, mean age 34.5, ranging 21-51) were included in the study. Two categories of ID were included, light (n=54) and limit (n=10). Statistically significant reductions (p<0.05) were observed for PII and GI in both study groups after 3 and 6 months, with no differences between groups. Lower calculus levels were observed in the powered toothbrush group at the 3-month visit (p=0.044). No relevant adverse effect or technical problems were observed.

**Conclusions** The use of powered or manual toothbrushes significantly improves plaque and gingivitis levels, in patients with mild to limit ID. The tested powered toothbrush was as effective and safe as the manual toothbrush, and showed some additional significant benefits in terms of calculus.

0020

**Evaluation of the Effects of the Probiotic Lozenges (Prodentis) or Subantimicrobial Dose Doxycycline (Periostat) as Adjuncts to Initial Periodontal Therapy: Double-blinded, Placebo Control, Clinical Trial**  
Cihangir, S.<sup>1</sup>, Alsulaimani, S.<sup>1</sup>, gursoy, h.<sup>1</sup>, Dirikan Ipci, S.<sup>1</sup>, Cakar, G.<sup>1</sup>, Kadir, T.<sup>2</sup>, Yilmaz, S.<sup>1</sup>

<sup>1</sup>yeditepe university faculty of dentistry, <sup>2</sup>Marmara University, Faculty of Dentistry

**Objectives** The objective of this study was to evaluate the effects of lozenges containing *L. reuteri* or subantimicrobial dose doxycycline as an adjuvant treatment to initial periodontal therapy for chronic periodontitis patients both clinically and microbiologically.

**Methods** A total of 30 patients were selected and randomly divided into 3 groups. Each patient had at least 2 teeth with one approximal site each with a probing depth (PD) of 5-7 mm and gingival index (GI) of  $\geq 2$  in each quadrant. Group I received scaling and root planing (SRP) plus *L. reuteri*-containing lozenges, Group II, received SRP+subantimicrobial dose doxycycline, Group III received SRP plus placebo. The plaque index (PI), GI, bleeding on probing (BoP), PD, and relative attachment level were measured. Microbiological sampling was performed at baseline and on day 90 were analysed by culturing.

**Results** At the end of the observation period, the measured PI, GI, BoP, and PD as well as the total viable cell counts and the proportions of obligate anaerobes were significantly ( $p<0.05$ ) lower in all treatment groups. Group I and Group II, revealed statistically significant ( $p<0.05$ ) results compared to Group III in all investigated parameters.

**Conclusions** Within the limits of this study, both of the adjunctive treatment modalities resulted in better clinical and microbiological outcomes. Further long-term studies are needed to evaluate the effects of these adjuncts in terms of immunological parameters.

0021

**Microbiological outcomes following non-surgical periodontal treatment and a 3 or 7 days systemic administration of Amoxicillin and Metronidazole**

Cosgarea, R.<sup>1,2</sup>, Eick, S.<sup>3</sup>, Juncar, R.<sup>2</sup>, Tristiu, R.<sup>2</sup>, Heumann, C.<sup>4</sup>, Arweiler, N.<sup>1</sup>, Sculean, A.<sup>3</sup>

<sup>1</sup>University of Marburg, <sup>2</sup>University of Cluj, <sup>3</sup>University Bern, <sup>4</sup>University Munchen

**Objectives** To evaluate the microbiological changes after scaling and root planing (SRP) combined with systemic administration of amoxicillin (AMX) and metronidazole (MET) for 3- or 7-days.

**Methods** 102 patients with chronic periodontitis (ChP) were randomly treated as follows: SRP (group A), SRP+AMX+MET (500mg 3 times-per-day for 3 days, group B) or with SRP+AMX+MET (500mg 3 times-per-day for 7 days, group C). At baseline, at 2 weeks, at 3 and 6 months after treatment, clinical parameters and microbiological profiles were evaluated. Pooled microbiological samples were taken from the deepest pocket in each quadrant and *A. actinomycetemcomitans*, *P. gingivalis*, *T. forsythia*, *P. intermedia*, *T. denticola*, *P. micra*, *F. alocis* and *C. rectus* were determined by real-time polymerase-chain-reaction

**Results** 91 patients have completed the evaluation period of 6 months. At baseline, there were no significant differences in terms of mean counts of the evaluated periodontopathogens. At all follow-ups, significant reduction ( $p<0.05$ , Wilcoxon Test) of *P. gingivalis*, *T. denticola* and *T. forsythia* was registered in all treatment groups. A significant reduction of *A. actinomycetemcomitans* was registered only 2 weeks after treatment with the two antibiotic protocols. At 6 months, *P. gingivalis* was significantly more reduced ( $p<0.05$ ) in groups B and C as compared to the placebo group, with no significant differences between the two antibiotic groups ( $p>0.05$ ). These groups also presented a significant reduction in the number of patients positive for *P. gingivalis*, *T. denticola*, *P. micra*, *F. nucleatum*, *C. rectus* and *F. alocis* as compared to placebo at 6 months, without a significant difference between them. These microbiological findings were in line with the clinical outcomes

**Conclusions** The present results have shown that: a) in patients with severe chronic periodontitis patients a 3- and 7-days systemic administration of AMX+MET adjunctive to SRP resulted in significant greater reductions of several periodontopathogens compared to SRP alone and b) the two antibiotic regimens yielded similar microbiological improvements.

0022

### **Restorative materials and pulp biomineralization**

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One aim in vital pulp therapy is the generation of new dentin-like hard tissue (tertiary dentin) to compensate for dentin loss; e.g. due to caries or trauma. For a long time, the standard material was calcium hydroxide to be placed on the exposed and healthy dental pulp. Recently, the use of dentin adhesives had been proposed for direct pulp capping. However, in cell culture experiments exposure of pulp cells to resin monomers, like TEGDMA, led to a down-regulation of biomineralization markers like alkaline phosphatase or dentin sialoprotein. Due to a depletion of glutathione (GSH), formation of reactive oxygen species (ROS) increased, which then led to oxidative DNA damage and, eventually, to apoptosis. N-acetyl-cysteine, a GSH precursor, reduced the ROS formation as well as the rate of monomer-induced apoptosis and compensated for the down-regulation of cellular biomineralization markers. During the setting reaction, tricalcium silicate cements such as MTA, release calcium hydroxide and stimulate tertiary dentin formation even to a larger extent compared to pure calcium hydroxide. However, classical MTA preparations have a long setting time, are expensive and may lead to tooth discoloration. A modified tricalcium silicate material with improved handling properties (Biodentine™) has been marketed recently. We studied the cytocompatibility and biomineralization effect of this material in contact with a three-dimensional culture of dental pulp stem cells. Cell viability was highest on the new tricalcium silicate cement followed by MTA, whereas viability on glass ionomer cement was significantly lower. Alkaline phosphatase activity decreased in cells on tricalcium silicate cement and MTA and expression patterns of marker genes were alike (COL1A1, ALP, DSPP, BSP and RUNX2). Increased viability and similar expression of mineralization-associated genes with the new tricalcium silicate cement and MTA indicate that the novel material is cytocompatible and bioactive.

0023

### **Filler technology in resin composites – past, present and future**

Palin, W.

University of Birmingham

From traditional dental resin composites with average filler sizes greater than 50µm to optimised filler distribution using particles in the nanoscale, fibre reinforcement, and the potential to realise bioactive properties, the development of optimised filler morphologies has significantly improved the mechanical, physical and aesthetic quality of composite materials. This presentation will briefly outline the development of resin-based composites in terms of their filler morphology; how resin composites are affected by filler size and loading in terms of mechanical strength, wear and aesthetics. Recent literature on novel filler design will also be reviewed including morphologies to improve handling, optimising curing light transmission and potential toughening mechanisms. Finally, discussion of the future potential of filler technologies to further improve, not only prerequisite mechanical strength and toughness, but that might also better interact and potentially augment oral tissues.

0024

### **SphereTEC™ – Granulated Spherical Filler Technology**

Weber, C.

DENTSPLY DeTrey GmbH

Generally, high filler load supports mechanical strength and reduces polymerization shrinkage of a composite. Maximum filler loads can be achieved by combining particles of different size categories: large particles form a pre-packed grid and smaller ones can occupy the space in between. This approach is widely used in dental composites and, depending on the size of combined filler particles, different types of hybrid composites are produced. More specifically, large fillers  $>1\mu\text{m}$  facilitate high filler loads due to their lower surface area and corresponding lower energy to wet the particles with resin. Yet, at the same time, they impair esthetical properties like a materials' gloss by being torn out under mechanical strain, leaving significant surface defects. On the other hand, smaller, i.e. sub-micron particles are favorable to obtain superior esthetics and generally better wear resistance, but are more difficult to wet, limiting the workability of a composite. To overcome the described technical conflict, the new generation of ceram.x® is equipped with SphereTEC™, the latest development in the field of composite filler technology. SphereTEC™ granulated composite fillers comprise glass particles of sub-micron size only. The average particle size of SphereTEC™ fillers is about  $15\mu\text{m}$ . When combined with isolated sub-micron particles, SphereTEC™ fillers allow the maximization of sub-micron glass filler load in a composite. Due to their specific morphology, SphereTEC™ fillers contribute to unique features of the new ceram.x. Most notably, they reduce the intrinsic friction of ceram.x® when under shear stress, facilitating excellent composite adaptation to cavity surfaces. Due to its distinct microstructure, SphereTEC™ fillers also reduce the amount of resin needed in a composite and thus minimize the stickiness to metal instruments. Upon polishing SphereTEC™ embedded sub-micron fillers are removed layer-by-layer providing a smooth surface. In vitro polishing data shows that SphereTEC™ fillers facilitate high gloss of the new ceram.x®.

0025

### **Saliva and oral health**

Pedersen, A. L.

Faculty of Health and Medical Sciences

Saliva is crucial for the maintenance of oral health and is one of the factors responsible for the ecological equilibrium in the mouth. Saliva also plays an essential role in a number of oral and gastrointestinal functions. The importance of saliva in the maintenance of oral health becomes evident when salivary flow is reduced, increasing the risk of oral diseases such as dental caries, erosion and oral candidal infections. The presentation focuses on factors and conditions influencing saliva flow rate and composition during a lifetime such as diet, physical activity and stressful events.

0026

### **Salivary Control of Oral Microflora**

Ruhl, S.

University of Buffalo

Saliva plays many varied roles in the defence of the oral cavity. Certain proteins and peptides in saliva function directly as general antimicrobial agents. These include lysozyme, lactoferrin, and lactoperoxidase as well as cationic antimicrobial peptides such as salivary histatins and defensins. A more specific recognition of microorganisms is provided by components of the acquired immune system present in saliva, predominantly secretory immunoglobulin A, and to a lesser degree other classes of immunoglobulins. Most of the major highly abundant salivary proteins act as modulators of the oral microbiota. On the one hand, salivary proteins serve as growth substrates and attachment sites for oral microorganisms leading under physiological conditions to the colonization of oral surfaces by a beneficial microflora. On the other hand, they can act as scavenger molecules by agglutinating planktonic microorganisms, thereby leading to their elimination from the oral cavity. This presentation will review the various ways by which salivary proteins interact with oral microorganisms. Particular emphasis will be placed on mechanisms of glycan-mediated binding of oral commensal bacteria and systemic pathogens to salivary glycoproteins. The findings presented here support the role of saliva as a gate keeper for microbes at the entrance to gastro-intestinal and respiratory tracts. Saliva maintains a balance by retaining a beneficial resident microflora in the oral cavity and at the same time eliminating potential pathogens that traverse the oral environment. Insight into the basic molecular mechanisms of bacterial adhesion may open up new avenues to prevent and control oral and systemic diseases associated with the pathogenic colonisation of host surfaces. Funding: NIDCR grant R01DE019807 (SR)

0027

### **Complementing salivary protection through oral care products**

Branding, M.

Unilever Oral Care R&D, UK

Complementing salivary protection through oral care products The importance of saliva in the maintenance of oral health is well accepted. The role of saliva includes digestion, protection of teeth and soft tissues, and its contribution towards maintaining an ecological equilibrium in the mouth. There are many mechanisms by which the composition of the oral microflora is modulated by saliva, including by inhibition of microbial growth through a variety of salivary proteins and enzyme systems. This presentation will describe an approach to oral hygiene inspired by the natural defence mechanisms in saliva. Oral hygiene products formulated with amyloglucosidase, glucose oxidase, lactoperoxidase, lysozyme, lactoferrin and immunoglobulin G will be discussed. These products are formulated to deliver biologically important salivary components to the mouth during use, to complement salivary protection against the causes of common oral problems.

0028

### **Retrospective Study of Single Implants: Survival, Prosthodontic Complications And Failures.**

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<sup>1</sup>University of Washington, <sup>2</sup>ClearChoice Dental Implant Center Portland

**Objectives** Few clinical studies exist on new generation implant designs and abutment connection designs for partially edentulous patients. The treatment course of 222 implants from surgery to prosthodontics to recall from November 2009 to August 2013 in an implant specialty team practice was studied.

**Methods** Electronic patient charts were reviewed for chart notes, radiographs, implant identification, clinical photographs, laboratory prescription and recorded on a spread sheet. Implant designs and abutment-implant connection designs placed were: Nobel Biocare: Branemark (BRMK)- external hex (HEX); NobelActive (ACT)- conical (CON); NobelReplace (REPL)- trilobe (TRI) or -CON. AstraTech: Osseospeed (ASTR)- CON. Southern Implant: (SOU) and -HEX or -TRI. Treatment planning-surgical placement goal was always screw-retained prostheses.

**Results** Distribution of 222 implants by location: MaxAnterior-22%, MaxPremolar-22% , MaxMolar-12%, MandAnterior-2% , MandPremolar-15%, MandMolar-27%. Distribution of system designs (Anterior/ Posterior): BRMK-HEX- 3/40; ACT-CON- 27/74; REPL-TRI-0/20; REPL-CON-1/21; AST-CON-22/5; SOU-HEX-0/5; SOU-TRI-0/4. Screw-retained prosthesis by location (Maxillary/Mandibular): Anterior=37%/100%, Premolar=68%/86%, Molar=88%/86%. Screw-retained PFM 70% of restorations. Screw-retained custom zirconia abutment 17% of restorations.

Complications and Failures: BIOLOGIC: Five implant osseointegration failures, all posterior (2.3%). Early implant failure (before loading): ACT=1. Late failure: BRMK=1; ACT=2; REPL-TRI=1. MECHANICAL: Screw loosening: 6.8% of all implants; by implant-abutment system designs: BRMK=2; ACT=7; REPL-CON=6. Vertical implant fractures (leading to implant failure)= 2.3% occurring in ACT-CON=4; AST-CON=1. Anterior screw-retained custom designed zirconia abutments fractured: AST=1, ACT=3.

**Conclusions** The biologic implant failure rate was 2.3%. Considerable prosthodontic complications or mechanical implant failures occurred predominately in the posterior areas. The ACT-CON and REPL-CON connection exhibited significant mechanical complications with screw loosening. Two systems with a conical abutment connection had implant vertical fracture of the implants. The overall implant failure rate was 4.5%. The goal of screw-retained prostheses was achieved for 73% of the implants.

0029

**Evaluation of the stability and bone changes of immediate, early and delayed loaded implants during the first year after loading.**

Akoğlu, M.<sup>1</sup>, Kurtoglu, C.<sup>1</sup>, Tatli, U.<sup>2</sup>, Salimov, F.<sup>2</sup>, Kurkcu, M.<sup>2</sup>, Ucar, Y.<sup>1</sup>

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**Objectives** The purpose of the present clinical study was to evaluate and investigate the difference in implant secondary stability parameters and bone density changes around, immediately, early and delayed loaded of single implants in the posterior maxilla.

**Methods** In this study 40 implants (Implantium, Dentium, South Korea) were placed in 34 patients. To determine prerequisites for immediate or early loading protocols; bone density value derived from CBCT (PreOpHu), subjective classification of bone quality (SBQ), insertion torque value (ITV) and primary implant stability (ISQ\_Primer) values were considered. 13 implants providing the prerequisites were loaded immediately, the other 13 of them were loaded early and 14 implants which were not providing the prerequisites, were loaded in delayed loading protocol. The secondary stability follow-up of the implants was made by using Osstell (RFA) device in 1st, 3rd, 6th, 9th and 12th months. Bone density around the implants was evaluated in the images from CBCT (12th month). Data was statistically analyzed using one-way ANOVA followed by post-hoc TUKEY test ( $p=0.05$ ).

**Results** Significant differences were not detected between loading groups in terms of 1st month ISQ values. However, ISQ values in 12th months of the immediate loading group were statistically higher than delayed loading group. No significant differences could be detected in bone density around the implants between the loading groups. Also, significant correlations were detected between bone density values derived from CBCT, subjective classification of bone quality (SBQ) and implant stability parameters (ITV, ISQ\_Primer)

**Conclusions** Within the limitations of this study, immediate or early loading protocols can be used for single implants with the presence of pre-conditions in the posterior maxilla. Also CBCT can be used as an effective method for the assessment of bone density and for estimating the stability parameters before surgery.

0030

**Evaluation of the mechanical, metallurgical and fractural properties of soldered DMLS metal frameworks.**

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<sup>1</sup>çukurova university, <sup>2</sup>ministry of health

**Objectives** The aim of this study was to compare the mechanical and metallurgical properties of direct metal laser sintered (DMLS) soldering vs. conventional soldering conducted on both DMLS and conventionally cast metal frameworks.

**Methods** Two groups of 3 unit CoCr metal frameworks including 1st-premolar, 2nd-premolar and 1st-molar were prepared using DMLS ( $n=45$ ) and conventional casting ( $n=45$ ) methods. Specimens in each manufacturing method were further divided in 3 subgroups ( $n=15$ ); DMLS soldered, conventionally soldered and non-soldered control-groups. Specimens in soldered groups were separated between 1st and 2nd premolars. The size of the separation-gap was standardized as  $2\text{mm} \times 3\text{mm}$ . Three-point-bending tests were carried out on stainless-steel molds. 2-way-ANOVA followed by Tukey-HSD test ( $\alpha=0.05$ ) was used for statistical analysis. Fracture surface of metal frameworks were evaluated using optical and scanning electron microscopes (SEM).

**Results** The mean fracture strength of the conventionally-soldered group ( $1334.3 \pm 547.1\text{MPa}$ ) was higher than that of DMLS-soldered group ( $881.7 \pm 572.8\text{MPa}$ ), but there was no statistically significant difference ( $p>0.05$ ) between the 2 groups. The mean fracture strength of both DMLS ( $19330.6 \pm 2405.7\text{MPa}$ ) and conventionally-cast ( $4268.5 \pm 1506.1\text{MPa}$ ) control groups were statistically significantly higher than the soldered groups ( $p<0.05$ ). A statistically significant difference was found between the control groups as well ( $p<0.05$ ). Optical microscope and varying magnifications of SEM images were in accordance with the mechanical properties. Soldered surfaces were observed only on the peripheral of the fracture surface where no integration was observed on the center yielding decreased fracture strength in the soldered groups.

**Conclusions** Both DMLS and conventional soldering methods decrease the fracture strength of metal frameworks. Soldering of metal frameworks should be avoided.

0031

### **Effects of surface treatment of powder metallurgy manufactured titanium on bond strength to veneering ceramics**

Viskic, J.<sup>1</sup>, Catic, A.<sup>1</sup>, Schauerl, Z.<sup>2</sup>, Balog, M.<sup>3</sup>, Krizik, P.<sup>3</sup>, Mehulic, K.<sup>1</sup>

<sup>1</sup>School of Dental Medicine, University of Zagreb, <sup>2</sup>Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, <sup>3</sup>Institute of Materials and Machine Mechanics, Slovakian Academy of Sciences

**Objectives** Commercially pure titanium (CP Ti) manufactured by cold isostatic and hot vacuum pressing (CIP/HVP) processes of powder metallurgy (PM) has not yet been used in prosthodontics. The aim of this study was to evaluate the effects of surface modifications of CP Ti substructures manufactured by powder metallurgy processes on bond strength with three veneering ceramics.

**Methods** 120 samples of CP Ti manufactured by PM shaped on WEDM were divided into 5 groups according to surface modifications: 1. untreated; 2. sandblasted ( $\text{Al}_2\text{O}_3$ ); 3. applied bonding agent; 4. sandblasted ( $\text{Al}_2\text{O}_3$ ) and applied bonding agent; 5. etched with hydrochloric acid. All samples were veneered with low fusing dental ceramics. Each group was divided into 3 subgroups of 8 samples according to veneering ceramics. Bond strength evaluation was done according to ISO 9693. The surface of the samples was evaluated by SEM and EDS analysis before and after modifications, after applying veneering ceramics, and after debonding.

**Results** Bond strength values were measured and results were compared to ISO 9693 requirements ( $>25$  MPa). The results of bond strength testing showed the following values: Duceratin Kiss veneering ceramics values range from 25,6 MPa to 41,2 MPa; Initial Ti from 12,7 MPa to 38,5 MPa; Titankeramik from 17,3 MPa to 38,5 MPa. ANOVA showed statistically significant differences in bond strength values within a group of veneering ceramics relative to surface treatment for the Duceratin Kiss group 4, the Initial Ti group 2 and the Titankeramik group 2. No statistically significant differences in bond strength values were determined between the veneering ceramics. The SEM and EDS analyses showed predominantly adhesive fractures between veneering ceramics and metal samples.

**Conclusions** CP Ti manufactured by PM veneered with low fusing ceramics meets requirements from ISO 9693 and could be used in prosthodontics as a metal base material in metal-ceramic systems.

0032

### **Effects of Sandblasting and Silicoating on Bond Strength Between Titanium and Porcelain**

Kumbuloglu, T. O.<sup>1</sup>, Toksavul, S.<sup>1</sup>, Toman, M.<sup>1</sup>, Tamac, E.<sup>1</sup>, Sarikanat, M.<sup>2</sup>, Yerlioglu, G.<sup>1</sup>, Karagozoglu, I.<sup>1</sup>

<sup>1</sup>Ege University, School of Dentistry, <sup>2</sup>Ege University Engineering Faculty

**Objectives** Aim of the present study to evaluate the effect of the different sized  $\text{Al}_2\text{O}_3$  particles and tribochemical silica-modified  $\text{Al}_2\text{O}_3$  particles on titanium surface in order to determine most effective method for increasing the bond strength of porcelain to titanium.

**Methods** Thirty rectangular plate of commercially pure titanium were milled using CAD/CAM systems for each group of airborne-particle abrasions. The specimens were divided into 3 groups, which were subjected to one of the following airborne-particle abrasion conditions: 1) Silica-modified 110 mm  $\text{Al}_2\text{O}_3$ ; 2) 150 mm  $\text{Al}_2\text{O}_3$  particles; 3) 50 mm  $\text{Al}_2\text{O}_3$  particles. The porcelain was applied onto the cleaned titanium plate surfaces. All specimens were prepared for four-point bending test on a universal testing machine. The strain energy release rate ( $G_c$  value) was calculated for each test group. The data was then analyzed using a one-way ANOVA and Bonferroni test for multiple comparisons.

**Results** Mean and standard deviation values of strain energy release rate ( $G_c$ ) values of titanium-porcelain complex were presented, respectively: Silica-modified 110 mm  $\text{Al}_2\text{O}_3$  24.5 (4.1) J/m<sup>2</sup>, 150 mm  $\text{Al}_2\text{O}_3$  18.6 (5.0) J/m<sup>2</sup>, 50 mm  $\text{Al}_2\text{O}_3$  20.8 (6.1) mm. The one-way ANOVA test indicated that there was a significant difference between the groups. ( $p=0.048$ ) According to Bonferroni test, there was a statistically significance between the silica-modified 110 mm  $\text{Al}_2\text{O}_3$  and 150 mm  $\text{Al}_2\text{O}_3$  groups. ( $p=0.048$ ) There were no significant differences between silica-modified 110 mm  $\text{Al}_2\text{O}_3$  -50 mm  $\text{Al}_2\text{O}_3$  and 150 mm  $\text{Al}_2\text{O}_3$ -50 mm  $\text{Al}_2\text{O}_3$  groups. ( $p>0.05$ )

**Conclusions** Within the limitations of this study, the following conclusions were drawn:

- 1) Airborne-particle abrasion with silica-modified 110 mm  $\text{Al}_2\text{O}_3$  indicated higher bond strength than airborne abrasion with 150 mm  $\text{Al}_2\text{O}_3$ .
- 2) There was no difference between airborne-particle abrasion with silica-modified 110 mm  $\text{Al}_2\text{O}_3$  and airborne abrasion with 150 mm  $\text{Al}_2\text{O}_3$ .
- 3) Tribochemical silica coating had an positive effect on particle size used in sandblasting technique.



0033

**Effect of recasting percentage of base metal alloys on the metal-ceramic bond strength**

Türk, A. G., Ulusoy, M.

Ege University School of Dentistry

**Objectives** Long-term success of metal ceramic restorations depends on metal ceramic bond. Castability plays an important role in selection of an alloy for casted dental restoration. This study was conducted to assess the effect of recasting of Co-Cr alloys on the bond strength of metal-ceramic.

**Methods** Different percentage combinations of new and once casted alloy were used to manufacture a total of fifty metal-ceramic samples for five groups (n=10). Metal discs (5 mm high-5 mm in diameter) were casted from 100% new alloy (G1), 75% new-25% once casted alloy (G2), 50% new-50% once casted alloy (G3), 25% new-75% once casted alloy (G4), 100% once casted alloy (G5). Opaque and dentin ceramics (4 mm high-4 mm in diameter) were fired on the metal samples. The shear bond strength test was performed in a universal testing machine with a crosshead speed of 0.5 mm/min. The data were analyzed with one-way ANOVA and the Tukey HSD test ( $p=0.05$ ).

**Results** The mean bond strengths (MPa) were; 80,67 for G1, 85,69 for G2, 81,25 for G3, 80,46 for G4, and 81,74 for G5. No significant difference was found between the groups ( $p>0.005$ ).

**Conclusions** There is no statistically difference between the bond strength value of the new alloy and the once casted alloy.

0035

**Investigation of polylactic acid membrane application possibilities in augmentation procedures**

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**Objectives** Aim is to investigate properties of polylactic acid material as a potential resorptive membrane material in GBR techniques.

**Methods** Purasorb PDLG 5010 (50/50 DL-lactide/glycolide copolymer; Purac Biomaterials, The Netherlands) was used. Granules of PLDG 5010 were heated (210°C) in aluminum mold to simulate 3D printing conditions and then gradually cooled during 30 minutes. The plate was cut into 2x5x20mm samples and inserted in three different solutions (saline, Ringer's solution and artificial saliva). The solutions were changed every seven days and samples masses measured. The samples were kept at constant temperature of 37°C.

**Results** After seven days, on first measurement, slight mass increase was noticed (average 0,002g). After fourteen days there also came to mass increase (average 0,003g). After 21 days samples lost their shape (they took the shape of test tube) and mechanical properties so further measurements were no longer possible.

**Conclusions** PDLG 5010 loses its shape and mechanical properties (strength) after 21 days. Therefore it is not adequate for time needed for bone augmentation. Further investigations with different sizes and shapes are necessary.

0038

### **Public Health Nurses and Oral Health Promotion for Preschool Children**

Løken, S., Wang, N. J., Wigen, T. I.

Institute of Clinical Dentistry, University of Oslo

**Objectives** The purpose of this study was to explore public health nurses' oral health promoting services for children.

**Methods** A questionnaire was mailed to all public health nurses working with children 3 years or younger in five counties in south-eastern Norway. The population in the studied area constituted one third of the country's total population. All children and their parents have regular contact with public health nurses during the first years of children's life, and at 3 years of age children are called to the dental clinic. Altogether, 163 public health nurses (55%) answered the questionnaire.

**Results** Most public health nurses (89%) reported to give oral health information often at consultations with young children, 56% did so before the age of 6 months. Nearly half of the public health nurses (46%) reported that inspection of children's teeth always was performed at age 2 years, either by public health nurse or by medical practitioner. Public health nurses reported that the majority of parents (67%) requested information related to oral health. Most questions were related to tooth eruption, toothbrushing and toothpaste. The majority of public health nurses (71%) was satisfied with their competence regarding oral health.

**Conclusions** The results of this study indicated that the current system where public health nurses integrate oral health in general health promotion and inspect young children's teeth at visits in health centres was implemented by a large proportion of public health nurses. Public health nurses not providing oral health information should be encouraged to include this service in health promoting activities.

0039

### **Evaluation of Digital Intraoral Radiographs Obtained by Dental Students: A preliminary study**

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**Objectives** The bisecting angle technique, when taken appropriately, reduces magnification and increases image sharpness as a result of placing the film closer to the teeth than in paralleling technique. However, since the bisecting angle technique is more prone to shape distortion, paralleling technique is the main technique in practical dental radiology courses. The aim was to evaluate the quality of digital intraoral radiographs obtained using both bitewing and bisecting angle techniques by 3rd grade dental students, who were theoretically taught on paralleling, bitewing and bisecting angle techniques and had the practical experience only for the paralleling technique on dental phantom models.

**Methods** The quality of digital intraoral radiographs taken with phosphor plate by 3rd year dental students was evaluated. The errors on the radiographs related with angulation of the tube head, placement and exposure of the film, and the radiographs, which needed repetition, were recorded on a form with a 4-point Likert scale. The type of the teeth were also noted.

**Results** Sixty-seven digital intraoral radiographs, including 9 bitewing and 58 periapical radiographs (13 mandibular molar, 11 maxillary molar, 7 mandibular premolar, 10 maxillary premolar, 2 maxillary canine, 8 maxillary incisor, 7 mandibular incisor) were evaluated. Female students took 45 (67.2%) of the radiographs. The percentage of radiographs that needed repetition was 13.4% and the error found in all repeated radiographs was related to positioning of the film, including the visibility of the apex. On bitewing radiographs the most prominent error was horizontal angulation error. None of the bitewing radiographs needed repetition. In 19 (28.3%) of the radiographs cone-cut was observed. On 20 (29.8%) of the radiographs vertical, on 14 (20.9%) of the radiographs horizontal angulation error was detected. Overall rate of angulation error was found to be 40.3%.

**Conclusions** The need for repetition of periapical radiographs taken by 3rd grade dental students seems to be high. Dental curriculum should be revised, so that the practical courses including bisecting angle technique as well as paralleling technique was taught both theoretically and practically. Further studies with larger samples are required in order to draw a conclusion.

0040

## **STUDY ON INFILTRATION LOCAL ANAESTHESIA FOR EXTRACTIONS IN THE POSTERIOR MANDIBLE**

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**Objectives** To record the data from extractions in the posterior mandibular arches over 14 years.

**Methods** Data was collected for each tooth that was extracted over fourteen years. Teeth extracted were mandibular molars and second premolars. Tooth extraction was performed in one dental practice by the same operator. Badly broken down teeth were extracted surgically. This involved flapless, bone sparing surgery with guttering with a tapered diamond bur and elevation using luxators. An intraligamentary local anaesthetic technique was used and achieved sufficient anaesthesia for extraction including surgicals. An intraligamentary syringe with a short needle was used at two points buccal and two points lingual. Demographic and qualitative and quantitative data were collected at the extractions and during the subsequent review appointment.

**Results** 272 mandibular posterior teeth were extracted in subjects aged 59-61 years. As part of a larger study all teeth were extracted using the intraligamentary technique and included 13% (n=119) second molars, 9% (n=79) first molars, 5% (n=46) second premolars and 3% (n=28) third molars. The average extractions performed per tooth using the intraligamentary technique was a median 27%, inter quartile range 18%-50%. The proportion of overall teeth extracted surgically over 6 years was 16% (n=43). All surgical extractions were performed using the intraligamentary local anaesthetic. The remainder of cases with intraligamentary anaesthesia were mostly for periodontitis (34%, n=92) and periapical infection (29%, n=80). There was no increase in adverse events or post-operative symptoms reported by patients compared with conventional techniques.

**Conclusions** Intraligamentary anaesthesia has been shown to be important to obtain sufficient anaesthesia for surgical extractions and extraction of teeth with irreversible pulpitis in particular the molar teeth. The length of anaesthesia was less than conventional anaesthetic techniques, due probably to the more ready dispersion of the local anaesthesia and there was no increase in post operative symptoms compared with conventional techniques.

0042

## **Experiences from National Reporting of Adverse Reactions to Dental Biomaterials**

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### **Objectives**

For over 20 years, the Norwegian Dental Biomaterials Adverse Reaction Unit has operated a national reporting procedure concerning suspected biologic adverse reactions associated with dental biomaterials. The procedure is based on spontaneous and voluntary reporting from dentists, physicians, and dental hygienists. The reporting form is designed to record all types of adverse reactions with any material. When the product and manufacturer is known, the reporter is encouraged to send information to the manufacturer as well. The objectives are to gain knowledge about material-associated adverse reactions and to monitor changes over time.

### **Methods**

Adverse reaction reports were registered in a database and analyzed with regard to the types of materials involved using multiple response analysis on a yearly basis. The following categories were analyzed: Dental amalgam, composites and cements, metals and alloys, and materials for short-term and transient use. IBM SPSS (version 21) was used for the statistical calculations.

### **Results**

From 1993 to the end of 2014, 2231 reports were received. The proportion of reports involving dental amalgam decreased over time from a peak of 89 % in 1994 to 28 % in 2014 ( $p < 0.01$ ). The proportion of the reports related to composites and cements has been relatively stable over the years and in 2014 39 % were related to composites and cements. Reports on materials for short-term and transient use have remained at the 15 % level. The proportion of reports on reactions involving prosthodontic metals and alloys increased from 13 % in 1993 to 43 % in 2014 ( $p < 0.01$ ).

### **Conclusions**

The Norwegian national manufacturer-independent reporting procedure provides longitudinal data concerning suspected adverse reactions to dental biomaterials. The potential complexity of biologic reactions warrants an assessment by a dedicated adverse reaction unit.

0043

### **Impact of Malocclusion and Caries on Oral Health-Related Quality of Life Among Kids**

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Institute of Health Sciences

**Objectives** The purpose of this study was to assess the relationship between caries, malocclusion and quality of life among children and their families.

**Methods** A pilot study was carried out with a representative sample of 106 preschoolers aged between 4 and 6 years old. The caries experience and prevalence of malocclusion were recorded using WHO criteria and Angle classification, respectively.

Each subject and their parent underwent separate supervised completion of a questionnaire addressing the parents' socioeconomic and demographic data and Early Childhood Oral Health Impact Scale (ECOHIS) questionnaire.

**Results** The children were divided into three groups excluding the children with no caries and malocclusion (n=8). Group 1: Children with only caries. Group 2: Children with only malocclusion. Group 3: Children with both caries and malocclusion. The three groups were shown not to demonstrate any differences in socio-demographic characteristics. Although, the impact of caries experience on the quality of life among these children and their parents could be observed, no such statistically significant association could be demonstrated between only with malocclusion and quality of life.

**Conclusions** A significant negative impact of malocclusion on both childrens' and their families' quality of life couldn't be shown. However, there is a need for further studies with an enlarged sample size.

0044

### **Risk Factors of Dentine Hypersensitivity among Turkish Young Adults**

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<sup>1</sup>Necmettin Erbakan University, <sup>2</sup>Necmettin Erbakan University

**Objectives** There is limited data on dentin hypersensitivity (DH) among young adults in Turkey. The objective of this study was to determine the prevalence and risk factors associated with DH among young adults in Turkey.

**Methods** A cross-sectional study was conducted on Necmettin Erbakan University Dentistry Faculty, Konya, Turkey. A sample of 665 young adults 18-30 year old of both genders participated in this study. Dentin hypersensitivity was diagnosed by means of subject responses to a question regarding pain in their teeth and gingivae. Data on age, gender, medical history, oral health habits, type of toothbrush, brushing technique, dental visit frequency, gingival bleeding, periodontal treatment frequency, smoking, bruxism, DH duration and pattern were collected by self-administered questionnaire completed by the subjects. Statistical analysis of data was made using the Chi-square test.

**Results** The prevalence of self-reported DH was 44.2% among the participants and it was significantly higher in females (56.2%) than males (p=0.019). Multiple regression analysis showed that bruxism had a significant association with tooth sensitivity (p=0.000). According to this study's results, there were an association between DH and type of toothbrush (p=0,037); DH and gingival bleeding (p=0,008). Other common etiological factors such as medical history, tooth brushing frequency, brushing before bedtime, smoking and periodontal treatment frequency were found to have a weak association with tooth sensitivity (p>0.05). The most common factor for DH was due to cold drink [210 (71.4%)]. Majority described their discomfort as sharp pain, cold as the initiating stimulus and drinking was mostly interfered with. Approximately 47.6% of the patients claimed that DH was present more than one year.

**Conclusions** Alone questionnaire provides limited results to determine the prevalence and risk factors associated with DH. Both clinical and questionnaire assessment needed to obtain more epidemiological data associated with dentine hypersensitivity .

### **The oral health-related behaviors of the unemployed adults in Finland**

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**Objectives** We compared oral health-related behaviors of the unemployed and employed and assessed whether these behaviors vary according to the length of unemployment.

**Methods** The study is part of the Nationwide Health 2000 Survey in Finland carried out by the National Public Health Institute in 2000-2001. The cross-sectional data on self-reported oral health, behaviors and sociodemographics were based on interviews and questionnaires. The present study was based on interview and included dentate 30-63 years old participants ( $n = 4670$ ). Current employment status in its dichotomous form, employed vs. unemployed, and length of unemployment categorized into four groups (one year or less, over one to 2 years, 2-5 years, and over 5 years) were used as exposures. Models of binary logistic regression were fitted separately for the oral health-related behaviors, each in its dichotomous form: daily tooth brushing frequency, habitual use of dental services, use of sugar in coffee or tea, use of gum with xylitol, smoking, and use of alcohol. Sociodemographics, socioeconomic, smoking, and alcohol were added as covariates to the models.

**Results** The unemployed reported brushing their teeth at least twice a day (53%) whereas the employed (64%). The regular use of dental services among the unemployed was lower (42%) than the employed (61%). In fully adjusted model, current unemployment is inversely associated with beneficial oral health-related behaviors in terms of regular use of dental services (OR 0.7, 95% CI 0.5-0.8), and use of gum with Xylitol (OR 0.7, 95% CI 0.6-0.9). After adjustments for income and education, the associations between unemployment and tooth brushing frequency and use of sugar in coffee or tea were statistically non-significant. Unemployment over 5 years was negatively associated with regular use of dental services (OR 0.2, 95% CI 0.1-0.6).

**Conclusions** The unemployed should be considered as a risk group for poor oral health-related behaviors.

### **Understanding avoidance and non-attendance among adolescents in dental care - an integrative review**

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**Objectives** This integrative literature review aimed to explore manifestations of avoidance of, or non-attendance to, dental care in order to identify background, concomitant, or potentially causal factors particularly associated with dental avoidance among adolescents (13-19 years).

**Methods** PubMed, CINAHL and PsychINFO were searched using keywords covering dental avoidance, non-attendance or non-utilization. Searches (May 2014, June 2014 and January 2015) were limited to peer-reviewed studies in English, published 1994-2014, on adolescent populations (13-19 years), giving 531 studies. Titles and abstracts were screened for relevance and 53 studies were independently evaluated by all authors ending up with 21 research articles to be included and transcribed into table formats. Outcome and background data were extracted, ordered, categorized, coded and summarized according to the integrative review method.

**Results** The 21 included articles were all of quantitative approach. Outcomes were identified as either dental avoidance or non-attendance/non-utilization. Three major themes of background, concomitant or potentially causal factors were identified and labelled Environmental, Individual and Situational factors. Only seven studies investigated factors associated with dental avoidance. Those studies were all from Sweden or Norway, two countries where dental care is free for children and adolescents, while the geographic spread was wide for the remaining 14 studies. For avoidance there were more focus on individual (psychosocial and psychological factors, personal characteristics, attitudes and lifestyle) and situational (dental and medical experiences, historical attendance patterns) factors, while some environmental (socioeconomy and cultural background) factors were more investigated for the outcome non-attendance/non-utilization.

**Conclusions** To understand avoidance or non-attendance among adolescents in dental care, attention must be paid to a wide variety of environmental, situational and individual factors. In a context of free dental care, there is a need for further research on the possible impact of modern life-style, psycho-social and cultural factors.

0048

## **ETHICAL ISSUES IN DENTISTRY: EVALUATION FROM STUDENTS' PERSPECTIVES**

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**Objectives** The aim of this study was to assess students' knowledge and opinion on ethical issues in dentistry by presenting 2 cases which pose ethical dilemmas.

**Methods** Two case scenarios related with ethical issues were presented to 39 senior dental students. The first case was related with a patient with multiple dental problems who refused to listen to the details and wished to sign the informed consent only. The second case was about a patient whose PFM bridge was fractured and wished to have another bridge done free of charge. The students were given 4 different options in terms of the correct approach and asked to select one. They were also asked to note additional comments if they thought of another option.

**Results** In the first case, the majority of the students (17) thought about starting minor treatments, however refused to proceed with implants or prosthetic treatments prior to consulting the patient. Eleven students insisted on explaining the patient about treatment options and risks before initiating any treatment, which was the expected answer. In the latter case, the majority of students (22) selected the first answer, which was to replace the fractured bridge, free of charge. Although there was no explicit answer to this question, the response of most of the students about replacing the bridge brought into question about the obligations of the dentist towards the patient and the significance of informed consent.

**Conclusions** Both cases presented emphasize the significance of informed consent and the responsibilities of the dental practitioner towards the patient as a healthcare provider. Students should regularly be informed about the importance of a thorough explanation of the advantages and risks to a patient prior to initiation of any kind of dental treatment.

0050

## **Worldwide Fluorosis Searches in Internet**

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**Objectives** Fluoride has beneficial effects on teeth at low concentrations, but during tooth formation excessive exposure to fluoride in drinking-water, or in combination with exposure to fluoride from other sources, can give rise to dental fluorosis. Google Trends is an online search tool of Google Inc. that allows the user to see how often a particular search-term is entered relative to the total search-volume across various regions of the world. Google Trends also shows in which geographic regions people have searched the term most. The aim of this study was to investigate the ten years data on internet search volumes and the most common geographic search locations regarding "fluorosis".

**Methods** Worldwide web search trend data in "oral & dental care" category over a period of ten years (4 January 2004 and 18 April 2015) retrieved from the Google Trends web site and examined for the search term "fluorosis" to identify search trends and regional interests.

Worldwide web search trend data in "oral & dental care" category over a period of ten years (4 January 2004 and 18 April 2015) retrieved from the Google Trends web site and examined for the search term "fluorosis" to identify search trends and regional interests.

**Results** The search volume of "fluorosis" showed slight changes during ten years. Colombia, Mexico, India, United States and United Kingdom were the most common regions for the "fluorosis" searches respectively. Guadalajara (Mexico), Bogotá (Colombia), Mexico City (Mexico), Santiago (Chile), Madrid (Spain) and London (United Kingdom) were the top cities which searched fluorosis.

**Conclusions** Geographical distribution of internet search volumes about fluorosis would provide free, publically accessible online data that could supplement traditional methodologies.

0051

**RCT in the field: Statistical consequence of wear, the proband's absence and lost-in-follow up**

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**Objectives** In order to assess the long-term success of dental restorations, observational and clinical trials are developed at academic institutes or universities. An essential prerequisite to evaluate the performance of dental materials on the long run is the regular follow-up of patients. In case of the absence or non-appearance of the subjects, the statistical power is affected and Kaplan-Meier survival estimate turn obsolete and are not applicable.

**Methods** A prospective clinical field study was established to evaluate the clinical performance of EquiaFil® with a nano-filled resin coating and the conventional Fuji IX GP fast® with LC coating (GPfast) according to the FDI restoration material evaluation criteria. 1002 fillings were placed by 144 private dental practitioners across Germany. Fillings were evaluated annually for a period of 4 years by external examiners according to FDI criteria.

**Results** In 1778 examinations over a period of four years, 660 fillings were evaluated in the first follow-up (NU1), 510 in the second follow-up (NU2) and 357 fillings in the third follow-up (NU3). 383 fillings were evaluated in NU1/NU2, 347 the NU1/NU2/NU3 and only 97 fillings are evaluated in the NU1/NU2/NU3/NU4. 68 restorations were evaluated in the NU2, 63 in NU1/NU3, 37 in NU3, 33 in NU1/NU3/NU4 and 24 only in NU2/NU3.

**Conclusions** The lost to follow-up patients in RCTs would lead to the problem of statistical interpretation of the time-effect. Kaplan-Meier survival analysis implements a better outcome because of missing regular follow-up evaluation. The change in the aesthetic, functional and biological parameters of direct fillings over time can be estimated using logistic mixed models adjusted to the influencing variables (age, sex, size, dentist and patient) and it is calculated in the odds-ratio for reintervention.

0052

**Oral Health Related Factors among Children with Congenital Heart Defects**

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**Objectives** *i*) to describe oral health complaints, access and use of dental services among children with congenital heart defects (CHD) compared to controls without CHD, and *ii*) to compare mothers' dental health related knowledge among both groups.

**Methods** Sudanese mothers of children with CHD (cases, N= 117, 3-12 yrs.) and without CHD (controls, N=190, 3-12 yrs.), were invited to participate in a face to face interview using a structured questionnaire. Interview items included: a) child's oral complaints during last 6 months b) child's access and use of dental services c) importance of tooth brushing and fluoride use in preventing caries d) impact of frequent intake of sugared foods/drinks on caries, e) impact of sugared milk/drinks in bottle during nights on caries.

**Results** The response rates were 94.8% (cases) and 95.7% (controls). Young cases (3-7 yrs.) were reported with statistically higher prevalence of oral complaints from mouth dryness and infected sore gums compared to controls (25.3% vs 4%,  $p<0.05$  and 14.8% vs. 5%,  $p<0.05$ ), respectively. Unavailability of a near dental clinic was reported more often among cases' mothers (34.2%) than controls (14.2%), ( $p<0.05$ ). Reports of the child's dental visit were unsatisfactory; 21.8% among cases and 21.6% among controls. Mothers' knowledge regarding the importance of brushing and fluoride use was similar among cases and controls. Eleven percent of cases' mothers didn't know the negative impact of sugared foods/drinks on caries, compared to 1.7% in the controls' mothers ( $p<0.05$ ). Thirty-six percent of the cases' mothers vs 19.7% of the controls' mothers, did not know that sugared milk/drinks in bottle during nights is causing tooth decay ( $p<0.05$ ).

**Conclusions** Cases were reported with more oral health complaints than controls. Among cases, mothers reported lower access to dental care. In both groups low dental visits for children were reported. Lastly, cases' mothers had lower knowledge about factors causing caries.

### **Oral health status and the quality of root canal treatments in patients in Zagreb, Croatia**

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School of Dental Medicine University of Zagreb, Croatia

#### **Objectives**

The aim of this study was to investigate, by use of analysis of orthopantomograms, oral status and quality of endodontic treatments in patients who came for treatment to Dental Clinic of School of Dentistry University of Zagreb.

#### **Methods**

As most patients visiting our Clinic have to take orthopantomogram, in this study we used image base of our RTG laboratory. Total of 2177 orthopantomograms were examined. DMF index and quality of endodontic treatments were calculated. Quality of endodontic treatments was calculated based on filling length and presence of periapical lesions regardless of their size. According to age, subjects were divided into 6 groups: <20; 21-30; 31-40; 41-50; 51-60; >60 years. Regarding quality of endodontic treatments, subjects were divided into 3 groups: incisors, premolars and molars.

**Results** Average DMF index in the whole population was 15.30, but it varies considerably regarding age of the subjects (Image 1). The lowest values were in a group <20 (DMF=3.55), and the highest in a group 60> (DMF=20.06). From the total number of endodontically treated teeth (N = 5504), there were more poorly treated teeth. Group of incisors shows highest percentage of success and that of molars the lowest (Images 2, 3).

#### **Conclusions**

In conclusion, the DMF index considerably increases with age, indicating the need for better control of older age groups in order to improve their oral health. Unfortunately, the general quality of endodontic treatment was poor, indicating need for intense programs of education and training of dental practitioners.

### **CHANGE IN DMFT COUNTS IN ADULT POPULATION OF LJUBLJANA OVER A 20-YEAR PERIOD**

SKALERIC, U., Skaleric, E.

University Clinical Center

**Objectives** The aim of our study was to assess the change in DMFT counts in adult population of Ljubljana over a 20 - year period.

**Methods** We included in our study 238 35-85 year old Ljubljana citizens that had already attended two epidemiological studies on Ljubljana population 10 (Skaleric& Kovac-Kavcic, 1991) and 20 (Kovac-Kavcic& Skaleric, 2001) years ago. Among the examined were 100 men and 238 women. The number of examined in each age group was as follows: 50 35-year olds, 21 45-year olds, 48 55-year olds, 56 60-year olds, 42 75-year olds and 21 85-year olds. We examined our patients at the Department of Oral diseases and Periodontology in Ljubljana Dental Clinic. We used the DMFT index to assess the state of teeth as the same index had been used in the previous two studies.

**Results** In a 20-year period we could observe an increase in average number of carious teeth in all age groups (except in 35-year old population where a decrease was seen), a decrease in average number of missing teeth in all age groups and an increase in average number of filled teeth in all age groups. DMFT values decreased in all age groups (except in 45-year old population) mainly on behalf of decrease of average number of missing teeth in a 20-year period. In all age groups patients had in average 3.2 more teeth in their oral cavity than the same age groups 20 years ago.

**Conclusions** We can conclude that the average number of teeth in adult population of Ljubljana is increasing.



0055

### **Diagnostic Methods for Dental Caries Used by Private Dental Practitioners in Ankara**

Koç Vural, U., Gökalp, S.

Hacettepe

**Objectives** The present study aimed to investigate the preference profiles of various types of diagnostic tools and methods used by private dental practitioners in Ankara for detecting dental caries.

**Methods** Private dental practitioners, in five districts of Ankara, were provided with questionnaires comprising four main headings, demographic characteristics, possession of dental imaging systems, and methods used for caries diagnosis, in order to document their preferential methods for caries diagnosis. The questionnaires were retrieved after 1–3 visits. Data were statistically analysed using frequency analysis and Chi-square tests.

**Results** The completed questionnaires were obtained from 328 dentists (160 women and 168 men) aged 25–69 years; 28.4% of them were specialists. Most participants possessed a dental radiography (RG) device. Air drying and sharp explorers were the most commonly preferred methods used for caries diagnosis. There was no significant association between using a sharp explorer and sex or being a specialist ( $P = 0.110, 0.226$ , respectively). Almost one-third of the dentists with an experience of <11 years, never used a RG device to detect occlusal caries ( $P = 0.003$ ), whereas one-fifth of the practitioners reported using fiber-optic transillumination or laser devices for caries detection.

**Conclusions** In addition to the fundamental equipment used in modern dentistry, dentists should be encouraged to use contemporary methods for the diagnosis and treatment of dental caries.

0056

### **Influence of Size of Toothbrush Head on Oral Hygiene Indices**

Zimmer, S., Pohlmann, S., Barthel, C.

Witten/Herdecke University

**Objectives** To evaluate the efficacy of two manual toothbrushes with different size of brush head in a randomized controlled trial after eight weeks.

**Methods** Sixty healthy volunteers (30 females, 30 males) took part in the parallel-design examiner-blind study. After screening examination and stratification by age, sex, and papillary bleeding index (PBI), participants were randomly assigned to two groups ( $n=30$  each): group 1 (TePe select, brush head  $25.8 \times 11.6$  mm), group 2 (TePe compact, brush head  $21.2 \times 9.6$  mm). Subjects were advised to brush with the assigned toothbrush two times/day for two minutes each using the modified Bass-technique. All participants used the same toothpaste (Colgate Total). At baseline, after four and eight weeks, the Quigley-Hein plaque index (QHI), the modified proximal plaque index (mAPI), and the PBI were recorded. Changes between baseline and four weeks and between baseline and eight weeks were calculated as medians. The null hypothesis was that the toothbrush with the small head would lead to better results. Kruskal-Wallis- and Mann-Whitney U test were used for statistical analysis.

**Results** Between baseline and four weeks the following changes (median, positive values are improvements) were found (QHI, mAPI, PBI): group 1: 0.071, 0.091, 0.222; group 2: 0.178, 0.042, 0.092. Between baseline and eight weeks, the respective changes were as following: group 1: 0.214, -0.055, 0.426; group 2: 0.134, -0.038, 0.178. No statistical significant difference was found with respect to QHI and mAPI between groups. However, the improvements in PBI were statistically significant higher in group 1 after four and eight weeks ( $p < 0.05$ ). Therefore, the null hypotheses was rejected.

**Conclusions** The toothbrush with larger brush head was superior to the commonly recommended short-headed toothbrush with respect to PBI and not different with respect to plaque indices after four and eight weeks of use. Consequently, the recommendation of short headed toothbrushes might be questioned.

0058

***Efficacy of N<sub>2</sub>O/O<sub>2</sub> inhalation sedation with or without midazolam on childrens' behavior during dental treatment***

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**Objectives** This study aimed to compare the effectiveness of nitrous oxide/oxygen (N<sub>2</sub>O/O<sub>2</sub>) inhalation sedation with N<sub>2</sub>O/O<sub>2</sub> + midazolam on childrens' behavior during dental treatment.

**Methods** The study group comprised 28 boys and 32 girls (ASA 1), whose mean ages were 65.48±11.29 months. The mean dmft of study population was 10,36±3.19. Children with definitely negative behaviour ratings on the Frankl Behaviour Scale (Score 1 or 2) were included. All children needed at least two sedation appointments. Patients were randomly assigned to receive 50%-50% N<sub>2</sub>O/O<sub>2</sub> inhalation sedation with or without midazolam administered intranasally at 0,2 mg/kg. The alternative procedure was administered at the following appointment. The duration of treatment, as well as number of treated teeth were recorded for all sessions. The behavioral outcome was evaluated with the Houpt Modified Scale.

**Results** The study groups did not differ significantly with respect to childrens' behavior during dental treatment (p>0.05). No statistically significant difference was found between study groups for duration of procedures (p>0.05). However, the number of treated teeth increased in midazolam group significantly (p<0.05).

**Conclusions** Both methods were found to be effective in reducing dental anxiety in children

0059

**Evaluation of Edentulous Patients with Panoramic Mandibular Index**

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**Objectives** The aim of the study was to evaluate the mandibular bone quality of healthy edentulous patients and edentulous patients with some disorders affecting skeletal metabolism with comparison according to panoramic mandibular index (PMI) values.

**Methods** 47 edentulous patients with panoramic radiographs were included in this study. Medical histories of these patients were reviewed. 17 patients with systemic disorders affecting skeletal metabolism were regarded as study group while control group consisted of 30 patients that have no systemic diseases which might affect skeletal metabolism. Measurements were performed in the right and left mental foramen regions on panoramic radiographs and statistical analysis was made after determination of inferior and superior PMI values. Statistical analysis was performed using SPSS (Version 15.0; SPSS, Chicago, IL.) Results were calculated by Students t-test, and Oneway ANOVA test.

**Results** Right and left inferior PMI and right and left superior PMI means were found as 0.34±0.08 and 0.28±0.07, respectively. Inferior and superior PMI values were not statistically significant when age, sex and systemic disorders has taken into consider (p>0.05).

**Conclusions** Comparison of healthy edentulous patients and edentulous patients with some disorders affecting skeletal metabolism showed no statistically significant differences according to panoramic mandibular index.

0060

### **Biomarkers in gingival crevicular fluid for diagnosis of Asymptomatic Apical Periodontitis**

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**Objectives** To assess levels and diagnostic accuracy of a set of potential biomarkers in Gingival Crevicular Fluid (GCF) of subjects with Asymptomatic Apical Periodontitis (AAP).

**Methods** In this cross-sectional study, the GCF samples were obtained from tooth sites of subjects with diagnosis of AAP (n=44) and healthy controls (n=31). Total Protein Concentration (TPC) was determined by the Bicinchoninate method. The gelatinolytic activity of Matrix Metalloproteinases (MMPs) -2 and -9 was determined by zymography and densitometric analysis. The MMP-8 levels were determined by ELISA and IFMA. The direct bone markers (DKK-1, Osteonectin, Periostin, TRAP-5 and OPG) were determined by the multiplex quantitative method. For comparisons among groups, the Mann-Whitney tests was used. For evaluating markers of interest such as diagnostic accuracy tests, ROC curves were made and the area under the curve (AUC) was calculated. Statistical analysis was performed using linear mixed-effects models and Stata V12 software and the statistical significance was considered with a value of  $p < 0.05$ .

**Results** The proenzyme, active form, and activation rate of MMP-9 and levels of MMP-8 were significantly higher in tooth sites of subjects with AAP when compared to healthy subjects ( $p < 0.05$ ). The markers' diagnostic accuracy analysis revealed that tooth sites with AAP, the MMP-8 and active MMP-9 marker showed a high diagnostic accuracy ( $AUC > 0.9$ ).

**Conclusions** GCF composition is modified by AAP. MMP-8 and active MMP-9 have diagnostic value for AAP.

0061

### **Morphology of maxillary and mandibular teeth analyzed by cone-beam computed tomography in a Turkish sub-population**

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**Objectives** The aim of the present study was to evaluate the morphometric aspects of anatomy of the root canal system of maxillary and mandibular teeth

**Methods** Patients referred for a CBCT radiographic examination for accurate diagnosis and treatment planning were enrolled in the study. A total of 147 patients with 1764 maxillary premolars, maxillary molars and mandibular canine teeth (each tooth group consisted of 294 tooth) were included. The number of roots and their morphology, number of canals per root, canal morphologies according to Vertucci classification, location of apical foramen, fused roots and primary variations were recorded. Assessments were done by an oral radiologist and an endodontist.

**Results** The state of being three roots for maxillary first and second premolars were 3% and 1% respectively. According to vertuci classification of roots in maxillary first premolars were 66% type I in buccal canals and 62% type I in palatal canals and in second maxillary premolars were 55% type I in buccal canals and 41% type I in palatal canals. The fused roots for maxillary first and second premolars were 8% and 10% respectively. The states of being 2 canals in buccal root were 22% in maxillary first premolars and 35% in maxillary second premolars. In maxillary first premolars, 48% in buccal root, and 66% in palatal root the foramen was on the tip of the root. These values were 49 % and 88% for maxillary second premolars. In maxillary first molars, the classification of mesiobuccal, distobuccal and palatal canals were 39% type II, 78% type I and 86% type I respectively.

**Conclusions** The root and canal configuration of a Turkish sub-population showed different features. CBCT scans can enhance the understanding of root canal anatomy and provide a precise description of these unusual anatomical variations with the potential of improving the outcome of endodontic treatment.

0062

**Reliability of Nasolabial Measurements on Plaster Casts and Three Dimensional Stereophotogrammetric Images of Casts in Infants with Unilateral Cleft Lip and Palate**

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**Objectives** The purpose of this study was to determine the inter-, intrarater and intermethod reliability of nasolabial measurements on plaster casts and three dimensional (3D) stereophotogrammetric images of casts in infants with unrepaired unilateral cleft lip and palate (UUCLP) performed by experienced and inexperienced rater.

**Methods** Preoperative extraoral plaster casts from 42 patients with UUCLP were measured with digital caliper and image acquisition of casts were performed with 3dMDface stereophotogrammetry system (3dMD, Atlanta, GA). Two raters (1 experienced, 1 inexperienced) evaluated 19 nasolabial measurements on two separate sessions. Intraclass correlation coefficients (ICC) were used to determine intra- and inter-rater, and inter-method agreement for each measurement.

**Results** ICC for measurements on casts/ 3D images for experienced; inexperienced rater ranged between 0.814-0.989/0.509-0.999; 0.43-0.942/0.53-0.97, respectively. Most measurements had interrater ICC greater than 0.75 and mean differences less than 1mm. Regarding intermethod reliability ICC of almost all measurements of experienced rater and 1/3 of inexperienced rater were greater than 0.75. Intra-, interrater and intermethod reliability was less in measurements of nasal, philtrum and nasal floor width.

**Conclusions** Measurements of gross dimensions like nasal width, of small dimensions like nostril floor width (non-cleft side) and deformity affected anatomic parts like philtrum width presented low reliability. The intra and interrater reliability of 3D measurements was high performed by experienced rater. Moreover, the reliability of 3D measurements compared with those made on plaster casts was higher in inexperienced rater. Measurements on 3D images were more sensitive and userfriendly in deeper identifications. Therefore, it may be recommended to use stereophotogrammetric 3D images of infants with CLP for nasolabial measurements especially if performed by inexperienced users

0063

**Impacted canine traction length assessment using measurements and 3D angle**

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**Objectives** Although cone beam CT provides information about the canine position in space (3D), usually only measurements in axial, coronal and sagittal planes were used to assess the impacted canine's three-dimensional position.

Our null hypothesis was that there is no relationship between a three-dimensional position of impacted canine and the orthodontic traction length.

**Methods** The database (interval from 2008-2012) of CBCT scans of a multidisciplinary clinic was checked on the subject of impacted canines. One hundred twenty-eight impacted canines (in 105 patients) were retrieved from the database. The patient's records were revised and the patients who came for the second consultation were included in the study (111 canines, 92 patients). The scans were uploaded in the freeware program Osirix, allowing assessment of the canine in the coordinate system. A formula to calculate the three-dimensional angle between occlusal plane and impacted canine was created. Linear and angular measurements were assessed on axial, sagittal and coronal planes. Length of traction was measured from the first traction appointment until impacted canine was in the dental arch, not counting all the rotation if needed.

Normal distribution was checked and associations between variables were analyzed by Pearson's correlation coefficients, and linear regression analysis was used to identify factors that had a possible influence on the traction length.

**Results** Statistically significant correlations ( $p < 0.05$ ) were found between all linear and angular measurements, 3D angle and impacted canine traction length into the dental arch.

Impacted canine crown tip distance to the midline determined 34% association with the orthodontic traction length.

**Conclusions** Results suggest that the distance to the midline had a significant influence on the duration of the orthodontic traction.

0064

**Effect of Implantation of Dental Materials on the Serum Oxidant and Antioxidant Status in Rats**Tekin Bulut, E.<sup>1</sup>, SIMSEK, N.<sup>1</sup>, OTLU, O.<sup>2</sup>, BAY KARABULUT, A.<sup>2</sup>, AHMETOGLU, F.<sup>1</sup><sup>1</sup>Health and Science, <sup>2</sup>Biochemistry

**Objectives Objective:** To measure and evaluate the total oxidative stress and total antioxidant capacity of the AhPlus, Obtuseal, Micro Mega Mineral Trioxide Aggregate (MM-MTA), Biodentine (BD) materials in serum samples after the implantation into the subcutaneous tissue of rats.

**Methods Materials and Methods:** AhPlus, Obtuseal, MM-MTA, BA and BD materials were implanted into the subcutaneous tissue of 26 Wistar albino rats and 6 more animals used as a control group which had no operation. At the end of the 45 days animals were sacrificed by cervical dislocation after anesthesia and blood samples were obtained. The serum samples were separated from the cells by centrifugation at 3000 rpm for 15 min and stored at -20 °C and used for the analysis of total oxidant status (TOS) and total antioxidant status (TAS). The percentage ratio of TOS:TAS was used to calculate the OSI, a potential indicator of the degree of oxidative stress. Kruskal-Wallis and Conover test analyses were performed with IBM SPSS statistics 22.0 program and  $p < 0.05$  was considered statistically significant.

**Results Results:** There were no significant difference between the AhPlus, Obtuseal, MM-MTA, BD groups and control group. But for the TOS and OSI values there were statistically significant difference between MM-MTA and BD groups, MM-MTA and Obtuseal groups, BD and AhPlus groups and also Obtuseal and AhPlus groups.

**Conclusions Conclusion:** The presence of dental materials in the subcutaneous tissue seems not to affect systemic TOS, TAS and OSI values in rats.

GROUPS	MM-MTA (n=5)	Biodentine (n=5)	Obtuseal (n=5)	Control (n=6)	AhPlus (n=5)	p
TOS ( $\mu\text{mol/L}$ )	15,66 <sup>a, b</sup> (11,03-51,85)	6,86 <sup>c</sup> (3,75-15,78)	7,80 <sup>c</sup> (4,05-14,25)	12,14 (9,27-15,43)	12,96 (10,85-18,65)	0.027
TAS (mmol/L)	1,12 (0,57-1,58)	1,06 (0,93-1,30)	0,99 (0,74-1,13)	1,23 (1,09-1,49)	1,02 (0,88-1,10)	0.107
OSI	2,08 <sup>a, b</sup> (0,77-4,64)	0,63 <sup>c</sup> (0,40-1,21)	0,88 <sup>c</sup> (0,54-1,43)	1,00 (0,75-1,29)	1,27 (1,14-1,86)	0.046

Values are stated as median (minimum to maximum). a: significant difference compared with the BD group, b: significant difference compared with the Obtuseal group, c: significant difference compared with the AhPlus group.

0065

**Evaluation of In Vitro Genotoxicity of MTA Fillapex**Arslan, S.<sup>1</sup>, Ustun, Y.<sup>2</sup>, Tascioglu, N.<sup>3</sup>, Sagsen, B.<sup>2</sup>, Onal, M. G.<sup>3</sup>, Akbarova, Y.<sup>4</sup>, Dundar, M.<sup>3</sup><sup>1</sup>Erciyes University, Faculty of Dentistry, <sup>2</sup>Erciyes University, Faculty of Dentistry, <sup>3</sup>Erciyes University, Faculty of Medicine, <sup>4</sup>Erciyes University, Faculty of Pharmacy

**Objectives** The aim of the present study was to evaluate the genotoxicity and cytotoxicity of MTA Fillapex and AH Plus root canal sealers with Cytokinesis-block micronucleus cytome assay

**Methods** Ten mL of blood was taken from healthy volunteers and lymphocytes cultures were obtained from those samples. Different concentrations of MTA Fillapex and AH Plus root canal sealers were added to cultures and after then the cells with micronucleus (MN), with binucleus, the number of metaphases, nucleoplasmic bridge (NBP) and nucleoplasmic buds (NBud) were counted. A thousand cells were counted through the preparats and apoptotic, necrotic cells were counted.

**Results** MTA Fillapex root canal sealer's toxicity was raised by the increase of dosage. But except NBP parameter MTA Fillapex showed significantly less toxicity then positive control group. For NBP parameter there was no significant difference between MTA Fillapex and positive control. AH Plus sealer showed toxicity during the polymerization period.

**Conclusions** MTA Fillapex paste showed less cytotoxicity than AH Plus paste.

0067

## **Interleukin- 1 $\beta$ and Prostaglandin E<sub>2</sub> Levels in Gingival Crevicular Fluid Adjacent to Restorations of two Different Resin Composite**

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**Objectives** The aim of this clinical study was to compare a siloran (Filtek™ Silorane; FS) and a methacrylate (Filtek™ Z250; FZ250) based resin composite material with respect to do adjacent levels of interleukin 1Beta (IL-1 $\beta$ ), and prostaglandin E<sub>2</sub> (PGE<sub>2</sub>) in gingival crevicular fluid (GCF) of periodontally healthy children.

**Methods** 13 systemically healthy children, 6 males and 7 females (mean ages: 11,3 $\pm$ 0,8 years); who have at least a sound permanent first molar (PFM) and two PFMs with subgingival caries on buccal sites were enrolled in this study. Clinical parameters, including plaque index (PI), gingival index (GI), were assessed and GCF samples were collected from all the teeth at baseline. Then the subgingival restorations were performed with two different restorative materials. Test procedures were repeated on days 2, 7, 15 and 30. The levels of IL-1 $\beta$  and PGE<sub>2</sub> were quantified with enzyme linked immunosorbent assays (ELISA). The data for clinical parameters, IL-1 $\beta$  and PGE<sub>2</sub> were subjected to statistical analysis for differences among and within the groups with nonparametric tests, since the data distribution was not normal.

**Results** No significant differences were seen in PI and GI scores between the materials through the experimental period except 7 days measurements ( $p > 0.05$ ). Although IL-1 $\beta$  and PGE<sub>2</sub> levels in FZ250 group were higher than FS group on days 7 and 15 ( $p < 0.05$ ), on day 2 and 30, no significant difference were observed ( $p > 0.05$ ). Also both clinical and biochemical test parameters were showed similar results as sound PFM on day 30

**Conclusions** In conclusion restoration of subgingival caries lesions were positively improved gingival health. According to short term results FZ 250 seems to be worse than the FS, within the time clinical and biochemical responses of the test materials become similar.

0068

## **Determination of dose rates from radioactive elements in different dental ceramics used for prosthetic dentistry**

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**Objectives** Dental porcelains, having most natural and aesthetic materials due to their translucent forms are preferred for fixed prosthetic restorations considering the aesthetics. Some features such as color, light transmission, translucency are being acquired to ceramics. For this purpose also materials having radioactive property are added during production and fabrication stages meanwhile it is known that those materials with low radioactivity are not hazardous substances on human health.

**Methods** In this study, it has been done radioactive element analysis of different ceramic materials using for various ceramic systems and metal ceramic restorations. There were prepared 2 samples for each material and for each samples 15 grams of material was sufficient. There were performed analysis for totally 40 sample and each analysis lasted 7 days. All samples were turned into powder form so that it is studied the radioactive element difference between initial form of ceramic and ceramic in use in the mouth. Gama spectrometer device has been used for analysis and high-purity germanium detector has been used for gamma spectrometer measurements. In addition, radium, thorium, uranium and potassium analysis are also performed.

**Results** In accordance to the evaluation of radioactive test results, radioactive activity rate of uranium (U-238) ve thorium (Th-232) are determined lower than minimum detectable activity rates. Potassium (K-40) dose rate determined in zirconia ceramics is lower than minimum detected rate whereas it is determined high in other conventional ceramic samples. In addition, radioactivity concentration of potassium is determined between 1655 $\pm$ 51 Bq/kg and 2703 $\pm$ 84 Bq/kg values. Radium (Ra-226) dose rate determined higher than minimum detected rate.

**Conclusions** It was concluded that uranium, thorium, and radium ratio were very low for ceramic materials used and it had not a risk in case of radioactivity.

**Radioactivity levels of some feldspathic ceramic powders used in prosthetic dentistry**Kurkcuoglu, I.<sup>1</sup>, Tuna, S. H.<sup>1</sup>, Tozun, F.<sup>2</sup>, Kurkcuoglu, M. E.<sup>2</sup>, Ayçık, G.<sup>3</sup>, Belgin, E. E.<sup>3</sup><sup>1</sup>Süleyman Demirel University, Faculty of Dentistry, <sup>2</sup>Süleyman Demirel University, <sup>3</sup>Muğla Sıtkı Koçman University, Faculty of Science

**Objectives** Ceramics are widely used in dentistry and considered as the most natural-looking restorative materials for esthetic purposes. Gamma radiation, on the other hand, has a great potential of biological hazard due to its high penetration and ionisation ability. The aim of this study was to determine the natural gamma radiation levels of some commercially available ceramic powders used for fixed restorations.

**Methods** Forty-two feldspathic ceramic powder samples, used for opaque, dentine, enamel and transparent applications were selected from eight different manufacturers. Activity concentrations of the samples were determined in terms of uranium-238, thorium-232, radium-226 and potassium-40 activities. Measurements were performed on 30 grams of each powder samples using a gamma spectrometer with HPGe (High Purity Germanium) detector.

**Results** Analyses revealed that all the activity concentrations were above the Minimum Detectable Activity values (MDA values: 0.12 Bq/kg for <sup>238</sup>U, 0.14 Bq/kg for <sup>226</sup>Ra, 0.19 Bq/kg for <sup>232</sup>Th and 3.57 Bq/kg for <sup>40</sup>K). Uranium-238 activities in the samples were between 17.63 Bq/kg and 357.10 Bq/kg with an arithmetic mean of 125.88 Bq/kg. Potassium-40 activity concentrations are also important since the potassium content is high in the ceramics. It was found out that, the average potassium-40 activity concentration of the samples was about 2855.44 Bq/kg ranging from 2251.80 Bq/kg to 3522.29 Bq/kg.

**Conclusions** Within the limitations of this study, it was concluded that, uranium-238 activity concentrations of the all samples were lower than the limit value of 1000 Bq/kg defined by ISO and approved by EC (European Commission). Potassium activities of the dental ceramics were also below the official value for solid materials of European Commission Report.

**Combined toxicity of released elements from dental alloys**Haugli, K. H.<sup>1</sup>, Samuelson, J. T.<sup>2</sup>, Syverud, M.<sup>2</sup><sup>1</sup>Oslo and Akershus University College, <sup>2</sup>Nordic Institute of Dental Materials

**Objectives** To evaluate in vitro toxicity of combined exposure to released elements from dental alloys.

**Methods** The toxic potential of selected metal ions released from two Co-Cr alloys and one Pd-Ag alloy was evaluated in a human monocyte cell-line (THP -1 cells). Measurement of the activity of mitochondrial succinate dehydrogenase (SDH) was used for viability assessments (MTT assay). Cytotoxic effects were also evaluated after exposure to combinations of the various metals in respect to their alloy type. The MTT assay results were supplemented with flow cytometric cell growth analysis to evaluate if reduced SDH activity was due to cell death or cell growth inhibition.

**Results** Zn(II) and Co(II) reduced the number of viable THP-1 cells (total SDH activity) in a concentration dependent manner. Combined exposure with other metal compounds did not alter this effect. Cell cycle analyses indicate that reduced SDH activity after Co exposure was a result of both cell growth inhibition and cell death. The cell growth pattern of Zn(II) and Co(II) exposed cells was not affected by other elements.

**Conclusions** Zn(II) and Co(II) was cytotoxic in a concentration dependent manner in THP1- cells. Combined exposure with other elements did not alter the toxic response to Zn(II) and Co(II).

### **A preliminary study on the migration of metallic constituents originating from Ag-Pd-Cu-Au cast post: experimental study**

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#### **Objectives**

Corroded metal ions from intra-oral restorations could stimulate metal allergic response. Since, the mechanism of the metal allergic disease is not yet understood in every details, removing the restorations which contain suspected allergen and expose in the oral cavity is still the gold standard treatment. In the case of metal cast posts that do not directly expose in the oral cavity, if their corroded ions in the root canal can permeate and invade periodontal tissue around the root, the allergic response might be triggered. To reveal whether removing the metal cast posts is necessary, the investigation of corroded metal in root dentin area around cast post is worthwhile.

#### **Methods**

Two types of experiments were performed under static and electrochemical stimulation conditions. Twenty-five lower premolars were endodontically treated and cast posts were set thereafter. For static condition testing, five specimens were immersed in 0.9% sodium chloride for 6 months. The remaining twenty specimens were used for electrochemical stimulation testing at four different levels (150, 300, 500 and 1000 mV). All specimens were longitudinally sectioned and then the corroded metallic constituents in root dentin areas were investigated using an energy dispersive X-ray spectrometer and an electron probe micro analyzer.

#### **Results**

In the case of static condition specimens, silver was detected at a depth of 30  $\mu\text{m}$ . While electrochemically stimulated specimens, silver and copper were observed and the longest distance of invasion was 300  $\mu\text{m}$ . Nonparametric Kruskal-Wallis analysis of variance showed a significant difference in the distance of invasion of silver among the four groups ( $P < 0.05$ ).

#### **Conclusions**

These results suggest that the plausibility of corroded ions from Ag-Pd-Cu-Au cast posts invading outward along dentinal tubules to reach the root surface is low. Hence, removal of allergens containing cast post in the metal allergic patient may have a lower priority.

### **Are titanium fixation screws biocompatible? An *in vitro* study**

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**Objectives** To evaluate the cytotoxic effects of titanium fixation screws on human gingival fibroblasts (HGF) and mouse osteoblasts (MC3T3-E1).

**Methods** The fixation screws selected were LEIBINGER, TRIMED, and LORENZ. Five samples were used for each group. Fixation System were each incubated in DMEM for 72 hours according to ISO 10993-5 standards. A real-time cell analyzer was used to evaluate cell survival. After seeding 200  $\mu\text{L}$  cell suspensions into the wells of an E-plate 96, HGF and MC3T3-E1 cells were treated with the bioactive components released by the materials and monitored every 15 minutes for 96 hours. Statistical significance was determined using one-way analysis of variance and Tukey-Kramer tests.

**Results** After 48 hours of elution, there were significant differences in the HGF cell-index values between the untreated control group and the study groups ( $P < 0.001$ ). In addition, the HGF cell-index values of the Leibinger ( $P < 0.001$ ), Trimed ( $p < 0.01$ ), and Lorenz ( $P < 0.01$ ) were significantly lower than that of the untreated control after 72 hours.

When evaluated the after 96 hours, while there were is significant differences among the HGF cell index values of the control and Leibinger ( $p < 0.01$ ) and Trimed ( $p < 0.05$ ) groups. There is no differences between the of the control and Lorenz ( $p > 0.05$ ) groups.

**Conclusions** Titanium based fixation screws caused a significant decrease in MC3T3-E1 cell viability, there was no adverse effect in all tested materials on human gingival fibroblasts.



0073

### **Impedance spectroscopy for measuring the extent of composite polymerization – comparison with Raman spectroscopy**

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**Objectives** To evaluate the impedance spectroscopy as a means for determining the extent of polymerization of composites based on amorphous calcium phosphate (ACP) by correlating the impedance measurements with the degree of conversion (DC) measured by Raman spectroscopy.

**Methods** Light-curable experimental composite materials were prepared by blending methacrylate resin (67% Bis-EMA, 23% TEGDMA, 10% HEMA) with ACP, barium glass (Ba) and silica (Si) fillers using a dual asymmetric centrifugal mixer. Four ACP-based materials and two control materials were prepared (numbers refer to the mass ratio of a certain component): ACP40-Ba10, ACP40-Si10, ACP40-Ba5Si5, ACP40-Ba9Si1, Ba40 and Ba40Si10. The electrical conductivity was calculated from complex impedance measured at 2 V and 1 kHz before the light-curing (80 s, LED, intensity of 1090 mW/cm<sup>2</sup>), during the curing and 24 hours post-cure. DC was determined using Raman spectroscopy by comparing the relative change of band at 1640 cm<sup>-1</sup> to the reference band at 1610 cm<sup>-1</sup> of uncured and cured material. The relationship between the changes in electrical conductivity and DC was explored using Pearson's correlation analysis.

**Results** The DC values (immediate/24h post-cure) were: ACP40-Ba10 81.2/81.9, ACP40-Si10 80.0/82.4, ACP40-Ba5Si5 80.6/83.0, ACP40-Ba9Si1 79.6/81.3, Ba40 40.9/61.1 and Ba40Si10 38.7/59.6. High positive correlation was found between the change of logarithm of conductivity and DC immediately after curing, as well as for the change of logarithm of conductivity and DC that occurred 24 hours post-cure, with correlation coefficients of 0.952 and 0.954 respectively ( $p < 0.01$ ).

**Conclusions** Excellent correlation between the impedance data and DC values obtained by a more established method (Raman spectroscopy) supports the use of impedance spectroscopy for assessing the extent of polymerization reaction.

0075

### **Mechanical properties, fracture resistance and fatigue limits of short fiber composite**

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**Objectives** The aims of this study were firstly to determine the fracture resistance and the compressive fatigue limit (CFL) of anterior crown restorations made of short-fiber reinforced composite (SFC) and secondly to investigate selected mechanical properties of the material following standards and observe their correlation with the CFL.

**Methods** Ten specimens/group were fabricated either from SFC (everX Posterior, GC) or particulate filler composite (PFC; Gænial Anterior, GC). Investigated properties were flexural strength (FS), compression strength (CS), diametral-tensile strength (DTS) and single-edge-notched-bend fracture toughness (FT) following ISO standards. Fracture resistance was determined by static load ( $n=10$ /group) and the CFL at 10 000 cycles was determined using a staircase approach ( $n=20$ /group), both on anterior composite crowns. All results were statistically analysed with analysis of variance (ANOVA) followed by Turkey *post hoc* test and Pearson-correlation analysis.

**Results** ANOVA revealed that restorations made from SFC had higher fracture resistance ( $954 \pm 121$  N) and CFL ( $267 \pm 23$  N) ( $p < 0.05$ ) than the PFC. SFC revealed also higher FT ( $2.60 \text{ MPa} \cdot \text{m}^{1/2}$ ) than the PFC ( $1.0 \text{ MPa} \cdot \text{m}^{1/2}$ ). From the mechanical tests investigated, strong correlation was observed only between the FT and the CFL ( $r^2=0.899$ ;  $p < 0.05$ ).

**Conclusions** Restorations made from SFC revealed promising performance under high static and fatigue loading. Based on the strong correlation with the fatigue resistance, this study showed that the fracture toughness can be used as parameter estimating the durability of restoration in high-load-bearing areas. As a result, the selection of the restorative material should be based on its fracture toughness value. In other words, SFC should be utilized in high-stress-bearing areas to yield enhanced toughness, which make the restorations more resistant to fracture.

0076

### **The effect of filler modification on mechanical behaviour of dental composite**

Yesil Acar, Z.<sup>1</sup>, Asilturk, M.<sup>2</sup>, Kiraz, N.<sup>1</sup>

<sup>1</sup>science, <sup>2</sup>Engineering

**Objectives** A dental composite typically contains an organic matrix and an inorganic filler. Usually, the filler particles are coated with a coupling agent to bond to the resin matrix. In particular, modification of filler's surface has affected properties of composites. In this study, the effect of filler modification on flexural strength of the composites has been evaluated.

**Methods** The organic matrix is comprised of 2,2-Bis[4-(2-hydroxy-3-methacryloyloxypropyl)phenyl]-propane, urethanedimethacrylate, and tri-ethleneglycoldimethacrylate and small quantity of initiators. The filler are consisted of a mixture of OX50 and M6000 which were modified with methacryloyloxypropyltrimethoxysilane(MPTS). While OX50 were modified with MPTS in the ratio of 5wt%, 6,3wt% and 9,5wt%, M6000 were modified with MPTS in the ratio of 0,63wt%, 0,95wt% and 5wt%. For three point bending test, 5 plate specimens, 2mmx2mmx25mm, were prepared for each composite and tested at 0,75mm/min. Flexural Strength (n=5) was measured by the method in ISO 4049.

**Results** Three point flexural tests were utilized to determine which was more durable. Maximum FS value was obtained at second system. While the modification ratio of OX50 was decreased to 5wt%, the modification ratio of M6000 was increased from 0,63wt% to 0.95wt%.

**Conclusions** The behaviour of the composite materials depends on their fillers: percentages, composition, dimensions and shape as well as the polymerization degree of the resin matrix. It has been shown that mechanical properties are highly correlated to the filler fraction of the dental composites. As a result of this study, we determined that modification of the filler surface is a very important fact and influence on the mechanical behaviour of the dental composites. The silane coupling agent bonds both silicon-oxygen in the fillers and methacrylate groups in the resin matrix. At high filler levels and small filler sizes, the silane coating of filler particles begins to rival the volume content of monomers in the dental composites.

0077

### **The effect of using prepolymerized filler on mechanical behaviour of dental composite**

Asilturk, M.<sup>1</sup>, Kiraz, N.<sup>2</sup>, Yesil Acar, Z.<sup>2</sup>

<sup>1</sup>science, <sup>2</sup>science

**Objectives** Mechanical properties of dental composite resins need to be improved in order to enhance their performance for applications. A dental composite has a high filler loading and low shrinkage thereby providing good strength. The use of prepolymerized filler particles (PRPF) inhibit the shrinkage of the composite. The prepolymerized filler particles are composed of a reinforcing filler and a nanofiller. The aim of this study was to compare composite systems that comprised of prepolymerized filler and M8000-R709 micro-midsize filler according to mechanical property.

**Methods** The organic matrix comprised of 2,2-Bis[4-(2-hydroxy-3-methacryloyloxypropyl)phenyl]-propane, urethanedimethacrylate, and tri-ethleneglycoldimethacrylate and small quantity of initiators. The micro-midsize fillers consisted a mixture of only R709 and M8000 were modified with MPTS. We prepared PRPF which comprised of 70wt% reinforcing filler (M8000), 5wt% microfiller (R709) and 20wt% organic matrix. For three point bending test, 5 plate specimens, 2mmx2mmx25mm, were prepared for each composite and test at 0,75mm/min. FlexuralStrength (n=5) was measured by the method in ISO 4049.

**Results** Particle size distribution of the PRPF was determined using Zeta-nanosizer(Malvern, MasterSizer 2000) which employs laser diffraction method. Three point flexural tests were utilized to determine which was more strong.

**Conclusions** Particle size measurement reveals that particle size distribution of the synthesized PRPF was homogenous in the water. The prepolymerized filler consists of particles having a particle size distribution including a mean particle size in the range of about 5 µm to about 55 µm. It is important to note the use of prepolymerized filler particles in terms of mechanical properties of the composite. The composite exhibits very low shrinkage. The flexural strenght of PRPF contains composite resin was much higher than the composite which was prepared by using micron particles.

0078

### **Microhardness of different resin composites of enamel and dentin shades**

Cruz, J., Sousa, T., Pequeno, A., Coito, C., Silva, A., Romão, B., Eira, R., Cavalheiro, A.  
Lisbon University

**Objectives** To compare the hardness of four different resin composites of enamel and dentin shades (XRV Herculite®, Herculite® XRV Ultra, Enamel Plus HRI® and IPS Empress® Direct) with Knoop test.

**Methods** Using a plastic caster, 80 resin composite discs (N=80) were prepared and submitted to microhardness evaluation. 10 specimens were prepared and assigned to one of the 8 groups: 1) XRV Herculite® enamel shade, 2) XRV Herculite® dentin shade, 3) Herculite® XRV Ultra enamel shade, 4) Herculite® XRV Ultra dentin shade, 5) Enamel Plus HRI® enamel shade, 6) Enamel Plus HRI® dentin shade, 7) IPS Empress® Direct enamel shade, 8) IPS Empress® Direct dentin shade.

All the specimens were kept in distilled water at 37°C for 24 hours and then tested with the Knoop microhardness test. Five (5) indentations were performed by specimen with a load of 50 g for 5 seconds. The data were analysed according to One-Way ANOVA and Scheffé post-hoc test, with a confidence level of 95%.

**Results** There was no statistically significant difference between the resin composites Enamel Plus Hri® dentin shade (261,916±17,148) and XRV Herculite® dentin shade (181,816±10,074). On the other hand, the difference found between the resin composite Enamel Plus Hri® dentin shade and the other resin composites included in this study was statistically significant: XRV Herculite® enamel shade (172,734±13,153), Herculite® XRV Ultra enamel shade (167,860±22,399), Herculite® XRV Ultra dentin shade (173,710±16,903), Enamel Plus HRI® enamel shade (155,154±16,518), IPS Empress® Direct enamel shade (115,788±11,210) and IPS Empress® Direct dentin shade (110,488±9,416).

**Conclusions** The Enamel Plus Hri® dentin shade seems to have a higher microhardness than the other composites evaluated.

0079

### **Surface Hardness Evaluation of Different Light Curing Composite Resin Restorative Materials**

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**Objectives** The aim of this study was to evaluate the surface hardness of ten nanohybrid ( Charisma Opal/Heraeus Kulzer/Germany, Charisma Diamond/Heraeus Kulzer/Germany, Filtek Ultimate Dentin, Enamel, Body/3M ESPE/USA, Quadrant/Cavex/Holland, Majesty Esthetic/Kuraray/Japan, Estelite Σ Quick/Tokuyama/Japan, Restorative Z250/3M ESPE/USA, Grandio/Voco/Germany ), a microhybrid (Charisma Classic/Heraeus Kulzer/Germany ) and a nanohybrid flowable restorative material Charisma Opal Flow/Heraeus Kulzer/Germany).

**Methods** Teflon molds ( 5mm diameter and 2 mm depth) were used to fabricate the specimens . Restorative materials were placed to these molds and light cured with a 1000mW/cm<sup>2</sup> LED device (Bluephase, Ivoclar Vivadent, Liechtenstein ) from the top surface. 5 samples were prepared from each composite resin restorative material. All samples were stored in 37°C distilled water for 24 h. After 24 h the top and the bottom surface hardness of the samples were measured using a Vicker's hardness tester ( Shimadzu HMV-2, Japan ) under 100 g load with a dwell time of 10 s. 3 measurements were performed from each sample's top and bottom surfaces and recorded as the hardness value. Statistical analyses were performed using SPSS for Windows.

**Results** The results of the microhardness test indicated that there was statistically difference between the top and bottom surfaces of microhybrid composite resin Charisma Classic and nanohybrid composite resins Charisma Diamond, Charisma Opal, Cavex, Filtek Ultimate Dentin, Majesty Esthetic. The highest hardness values were obtained from nanohybrid composite resin Grandio. Flowable nanohybrid composite resin Charisma Opal Flow showed the lowest microhardness values at all groups.

**Conclusions** According to the results of this study 20 s light curing could not adequately polymerize the bottom surfaces of some composite resins used in this study. Accelerating curing time may be recommended to cure the bottom surfaces of resin restorative materials.

**Evaluation of the Effects of Toothbrushing and Different Whitening Toothpastes on the Roughness and Microhardness of Nanofilled Resin-Based Composites**Kamak, H., Doğan, E., Erten, H., Türköz, E.

Gazi University Faculty of Dentistry

**Objectives** The aim of this study was to evaluate the influence of electrically operated toothbrush and six toothpastes with different formulations on the microhardness and surface roughness of a nanofilled resin-based composite (Aelite Aesthetic Enamel) after brushing.

**Methods** Aelite Aesthetic Enamel, a reinforced nanofil composite which was released to be used in the anterior region was used in the study. 56 composite resin samples were prepared in diameter of 5 mm and 2 mm in height. The surface of the samples were polished with polishing discs (Sof-Lex) and then the initial microhardness and surface roughness measurements were made with Vickers Microhardness Device and Profilometer sequentially and recorded. Then the samples were divided into 7 groups (n=8 ); and every single group was brushed with Oral- B Triumph 5000 Rechargeable Toothbrush, with one of the whitening toothpastes (Signal White Now Gold, İpana Luxe 3D Whitening, Colgate Optic White, Advanced Whitening, Yotuel , Plus White Xtra Whitening) for 10 minutes. After brushing the the roughness and microhardness values of the specimens obtained again and recorded. Initial and final data obtained were evaluated statistically by one-way ANOVA and t-test ( $p = 0.05$ ).

**Results** Group 1, 2, 6, 7 causes a statistically significant difference on the nanofil composite surface microhardness , also group 5, 6, 7 causes a statistically significant difference in the roughness of the surface of the composite ( $p<0.05$ ). Statistically analysis showed that, differences of surface microhardness for group 3 and 2 was significantly different than that for group 1 ( $p<0.05$ ). The most significant changes of roughness also observed in group 7 ( $p<0.05$ ).

**Conclusions** Whitening toothpastes of different ingredients used in this study was change the surface properties of the nanofill composite resin.

**Effect of a Surface Sealant Material to Surface Hardness and Roughness on Different Composites**gürbüz, Ö.<sup>1</sup>, Özsoy, A.<sup>1</sup>, Dikmen, B.<sup>1</sup>, Mert Eren, M.<sup>2</sup>, Cilingir, A.<sup>3</sup><sup>1</sup>Istanbul Mediipol University, <sup>2</sup>Kemerburgaz University, <sup>3</sup>Trakya University

**Objectives** Dental composite resins are commonly used materials for the replacement of hard dental tissues. The aim of this study was to evaluate the effect of a surface sealant material application to the surface hardness and roughness on different composites.

**Methods** Sixty disc-shaped specimens (10x3 mm) prepared for the tests and assigned into 6 groups (n=10). Discs in the group 1 prepared with Herculite XRV Ultra (Kerr Manufacturing Co.), group 2 with Beautifil Bulk Restoratif (SHOFU, Kyoto, Japan), group 3 with Filtek BulkFill Posterior Restorative (3M-ESPE, Germany), group 4 with Herculite XRV Ultra, group 5 with Beautifil Bulk Restoratif, group 6 with Filtek BulkFill Posterior Restorative. The restorative materials were light-cured under a polyester strip and glass according to the manufacturer recommendations. After curing the samples were polished using medium polishing discs for ten seconds and changed the discs after five specimens. Biscover LV polymeric resin was applied to groups 4, 5, 6. The samples stored in distilled water at 37°C for 24 hours. Subsequently, for surface hardness of the groups 1, 2, 3 Vicker's microhardness measured in a microhardness testing machine and a profilometer was used for assessing surface roughness to all groups. The data were analyzed by one-way ANOVA at the significance level of 0.05.

**Results** There were no significant differences in microhardness and roughness between the test groups of each restorative material. According to the results group 3 showed highest surface hardness and group 4 showed lower surface roughness values.

**Conclusions** In the light of this study, the highest hardness values were obtained with silane treated ceramic restorative after polishing. Although the smoothest surfaces were obtained with the use of glaze material after polishing discs resulted in significantly lower Ra values.

surface roughness values

Group	N	Mean	p
1	10	0.85	0.370
2	10	0.77	0.370
3	10	0.72	0.370
4	10	0.70	0.370
5	10	0.71	0.370
6	10	0.87	0.370

surface hardness values

Group	N	Mean	p
1	10	61.14	0.105
2	10	58.49	0.105
3	10	66.65	0.105

**The Effect of Finishing/Polishing Systems and thermocycling on the Surface Hardness and Roughness of Different Resin Composites**

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**Objectives** The aim of this study was to compare different Finishing/Polishing (F/P) systems on the surface hardness and roughness of different resin composites before and after thermocycling.

**Methods** A total of 126 composite disks (8x2mm) made of microhybrid (G Aenial Posterior) and nanohybrid (Filtek Z550 and Clearfil Majesty Posterior) were polished with Enhance (Dentisply), One Gloss PS (Shofu) or Sof-Lex Spiral finishing and polishing wheels. The average microhardness, surface roughness before and after 10.000 thermocycling were measured. Statistical analyses were done by the three-way ANOVA test. Bonferroni test was done for pair-wise multiple comparisons.

**Results** In all F/P systems at baseline and after thermocycling, the G-Aenial Posterior showed the lowest ( $p < 0.05$ ) microhardness values when compared with the other tested resin composites. Clearfil Majesty Posterior and Filtek Z550 exhibited similar microharness values. Microhardness values of all composites decreased according to baseline after thermocycling application. The lowest surface roughness results were observed in Sof-Lex Spiral applied resin composites ( $p > 0.05$ ). Each composites exhibited similar surface roughness with each other in case of using same F/P system. Also, thermocycling did not significantly affect the surface roughness of the resin composites.

**Conclusions** F/P system affects the microhardness values of Clearfil Majesty Posterior and G Aenial Posterior significantly, but same is not valid for Z550. Also, F/P has not a statistically significant influence on the resin composite surface roughness ( $p > 0.001$ ).

# **Effect of the different finishing and polishing procedures on the surface roughness of three different posterior composite resins.**

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**Objectives** To examine the effect of three different posterior composites on surface texture with various finishing and polishing procedures.

**Methods** In this study, three different posterior composites were used: Filtek P60, Clearfil Majesty Posterior and Cavex Quadrant Posterior Dense. These were used with a diamond finishing burr, a tungsten carbide burr and Sof-Lex discs. For each posterior composite, 15 metal molds were prepared, each 5 mm in diameter and 2 mm in depth. The surface smoothness of samples were measured at three separate points with a profilometer device and the values were recorded. In Group 1, a yellow band diamond burr. In Group 2, a 12-blade tungsten carbide burr. In Group 3, with thick, medium, fine, and super-fine Sof-Lex discs. The smoothness of the surfaces of the samples was measured with the same profilometer, the values were recorded, and the mean surface smoothness values (Ra) were calculated. A one-way analysis of variance (ANOVA) was applied for statistical analysis

**Results** No statistically significant differences were found between the composite resins with respect to surface smoothness when evaluated with an ANOVA ( $p > 0.05$ ). A statistically significant difference was found between the groups according to the Kruskal-Wallis variance analysis applied to the diamond, carbide, and Sof-Lex groups ( $p < 0.05$ ).

**Conclusions** Sof-Lex polishing system was more successful than the diamond and carbide burrs in the finishing and polishing procedures of composites.

The composite resins used in the study

Restorative materials	Content	Manufacturer
Filtek P60	Zirconium/silica, BIS-GMA, UDMA and BIS-EMA resin	3M ESPE Dental Products MN 55144-1000, St. Paul, USA
Clearfil Majesty Posterior	Silanated glass ceramic filling (avge: 1.5 $\mu$ m), aluminium micro filling (avge: 20 nm), Bis-GMA, hydrophobic aromatic dimethacrylate, TEGDMA, camphorquinone, accelerator, pigments and others.	KURARAY MEDICAL INC. 1621 Sakazu, Kurashiki, Okayama 710-0801, Japan
Cavex Quadrant Posterior Dense	Bis-GMA based. Hybrid composite produced with barium glass technology Free fluorides and radio-opaque	CAVEX Quadrant Posterior Dense, P.O. Box 852, Haarlem, Holland)

The finishing and polishing systems, properties and manufacturers

Finishing and polishing procedures	Properties	Manufacturer
Diamond finishing burr	Yellow band diamond burr	(Finishing Diamond burr Dilman Dental Enstrument, Turkey)
Tungsten carbide burr	12-blade tungsten carbide burr	(Carbide Burrs, Kerr, USA)

Sof-lex discs	thick, medium, fine and super-fine	(3M-ESPE, Dental Products, USA)
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The maximum, minimum, and median surface roughness values of the diamond, carbide, and Sof-Lex groups.

Groups	P60	Majesty	Cavex
Diamond			
Minimum	1,06	1,33	1,20
Maximum	1,80	1,65	1,40
Median	1,4000	1,4000	1,3300
Carbide			
Minimum	1,00	,86	,86
Maximum	1,80	1,26	1,93
Median	1,5300	1,1300	1,1300
Sof-Lex			
Minimum	,13	,13	,20
Maximum	,40	,60	,40
Median	,3300	,3300	,3300



0084

### **Effect of Polishing Procedure on Surface Roughness of Different Light Curing Composite Resin Restorative Materials**

Hazar, A.<sup>1</sup>, Özcan, S.<sup>1</sup>, Üçtaslı, M. B.<sup>1</sup>, Üçtaslı, S.<sup>2</sup>

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**Objectives** The aim of this in vitro study was to evaluate the surface roughness of 10 nanohybrid ( Charisma Opal / Heraeus Kulzer/ Germany, Charisma Diamond /Heraus Kulzer / Germany, Filtek Ultimate Dentin, Enamel, Body / 3M ESPE / USA, Quadrant / Cavex / Holland, Majesty Esthetic / Kuraray / Japan, Estelite  $\Sigma$  Quick / Tokuyama / Japan, Restorative Z250 / 3M ESPE / USA, Grandio / Voco / Germany ), 1 microhybrid ( Charisma Classic / Heraus Kulzer / Germany ) and 1 nanohybrid flowable ( Charisma Opal Flow / Heraus Kulzer / Germany ) restorative material before and after polishing procedure.

**Methods** 60 disc- shaped specimens with 5mm diameter and 2 mm depth were prepared. All specimens were cured with a 1000 mW/cm<sup>2</sup> LED device ( Bluephase, Ivoclar Vivadent, Liechtenstein) under mylar strip. After light curing, surface roughness values of all specimens were evaluated with a profilometer ( Surfest SJ-301 Mitutoyo, Japan ) three times from each group. After first measurement polishing procedures were performed to all specimens with same method. All measurements were performed again three times from each group. Statistical analyses were performed using SPSS for Windows.

**Results** The results of the study indicated that there was an increase in surface roughness values after polishing procedures. The highest surface roughness values were obtained from nanohybrid composite resins Grandio and Filtek Ultimate Dentin before and after polishing.

**Conclusions** Within the limits of this study, we can say that all composite resin groups showed acceptable surface roughness values before and after polishing.

0085

### **The effect of food simulating liquids on the surface hardness and roughness of ‘low shrink’ composites**

kedici alp. c., Ömürlü, H.

Gazi University

**Objectives** The purpose of this study is to investigate the effect of food simulating liquids(FSL) on the micro hardness and surface roughness of low shrinkage composites with different monomers (silorane based, kalore and nano-dimer based) and methacrylate based composite (Tetric N-Ceram).

**Methods** Low shrink’ materials (Kalore/kal, N’Durance/NDUR and Filtek P90/P90) and one control (Tetric N-Ceram)were tested. Specimens were fabricated in plastic moulds. After polymerization of composites, specimens were stored in FSL at degree of 37 in an incubator for 3 weeks. The control specimens were stored at room temperature . After this period, surface roughness and hardness values measured.

Vickers hardness numbers(VHN) were measured using a Shimadzu microhardness tester (HNV-2000, Shimadzu Corporation, Tokyo, Japan) with 100 g load applied for 15 s. The surface roughness was measured using a profilometer.

Data were subjected to One Way Anova and Post hoc and Bonferonni test.

**Results** The surface hardness and roughness of kalore and N,Durance significantly affected in, heptane and ethanol. the surface roughness of tetric is affected by all FSL. Surface hardness of P90 is effected by only ethanol. And surface roughness of silorane is effected only distilled water and ethanol.

**Conclusions** The food simulating liquids effect the surface hardness and surface roughness of Kalore and N’durance. The surface properties of P90 more stable than other low shrink composites in FSL.

0086

**Surface analysis of six composites: Atomic Force Microscopy and Rugosimeter**

Sousa, T., Cruz, J., Pequeno, A., Coito, C., Silva, A., Romão, B., Eira, R., Cavalheiro, A.

Lisbon University

**Objectives** To compare and quantify the surface roughness of three different resin composites of enamel and dentin shades (XRV Herculite®, Herculite® XRV Ultra and Enamel Plus HRi®) with a roughness test and atomic force microscopy (AFM).

**Methods** Using a silicone mould, 60 resin composite discs were prepared and analysed with a rugosimeter. 10 specimens were prepared and assigned to one of the 6 groups: 1) XRV Herculite® enamel shade, 2) XRV Herculite® dentin shade, 3) Herculite® XRV Ultra enamel shade, 4) Herculite® XRV Ultra dentin shade, 5) Enamel Plus HRi® enamel shade, and 6) Enamel Plus HRi® dentin shade.

12 additional resin composite discs were prepared using a plastic caster – 2 from each group – and analysed by atomic force microscopy (AFM). The specimens prepared for surface evaluation were finished and polished with the Jiffy Polisher® system, consisting of a sequence of three polishing rubber points; each rubber was used for 90 seconds under water refrigeration.

**Results** According to the Ra criteria, there are no statistically significant differences between the different groups. However, the composites Herculite XRV Ultra™ featured the minor Ra ( $0,304 \pm 0,023$ ) and the composites Herculite XRV™ presented the roughest surface ( $0,388 \pm 0,028$ ). The data were analysed according to One-Way ANOVA with a confidence level of 95%.

**Conclusions** Although no difference in surface roughness was observed among the resin composites, all of them presented roughness values higher than those mentioned in the literature as ideal.

0087

**Clinical outcome of a diamond versus a SiC and Al<sub>2</sub>O<sub>3</sub> polishing system for approximal tooth restorations.**

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Witten/Herdecke University

**Objectives** A smooth surface after the direct approximal restoration is of clinical importance, because is located in the interdental space. Finishing and polishing quality depends from the preparation design, filling material, finishing - polishing techniques and systems. It was the aim of this preliminary study to investigate two different finishing and polishing systems: a diamond versus a SiC and Al<sub>2</sub>O<sub>3</sub> system.

**Methods** Of 10 extracted caries free human molars approximal slot preparations on the distal and mesial surfaces were made. They were divided in two groups, group 1 for diamond (n=5) and group 2 for SiC and Al<sub>2</sub>O<sub>3</sub> (n=5) application of finishing and polishing systems. Fillings were made with composites Venus Diamond flow and universal Venus Diamond (Heraus Kulzer, GmbH, Hanau, Germany), finished and polished with Intensiv Diamond Strips (Intesiv SA, Grancia, Switzerland) and Super-Snap Polystrips (SHOFU DENTAL GmbH, Ratingen, Germany). The time of treatment was determined. A tactile control with a dental explorer. has been carried out. After finishing and polishing of each specimen 5 surface areas of the filling and enamel selected randomly and the surface roughness was determined as mean area roughness (Sa). The height difference between the surfaces of the filling and enamel (HDFE) in the area of the approximal marginal gap after finishing and polishing was measured. The data were compared statistically using the non-parametric Wilcoxon-Mann-Whitney U test.

**Results** No significant difference in the time of treatment ( $120 \pm 10$  seconds) and HDFE (group 1 median: 1.59, interquartile range: 4.81; group 2 median: 4.44, interquartile range 13.60) was determined after finishing and polishing with both systems. The enamel surface was significantly smoother after treatment with the diamond system, because the Sa values revealed a significant difference ( $p=0.024$ ).

**Conclusions** Both systems may be used for finishing and polishing of the approximal composite fillings.

0088

### **Effect of different types of polishing systems on the surface roughness and microhardness of different composites**

Ersoy, M.

Yeditepe University

**Objectives** The aim of this in –vitro study was to evaluate the effect of different polishing systems on the the surface roughness and microhardness of different composites

**Methods** Three different types of composite resins were used in the study. These were: Filtek Z<sub>250</sub> (microhybrid), Filtek Z<sub>550</sub> (nanohybrid) and Filtek Ultimate (nanofill) (3M ESPE). A total of 72 discs were prepared with dimensions of 8X3 mm. Eight discs were prepared for each type of composite. The polymerization of all composites were made using Blue Light ( Dentsply,Maillefer, Ballaguies, Switzerland) light curing device. The prepared samples were stored in an incubator at 37<sup>0</sup> C for 24 hours. The composite samples were divided into 3 groups according to the polishing system. These were: Groups polished with Pogo ( Dentsply,Maillefer, Ballaguies, Switzerland) and Spiral disk (3M ESPE): Eight discs were prepared for each polishing groups ( n:8). Surfqaace roughness was measured using Profilometer (Mahr Germany ). Microhardness was measured with 100 gr / 15 sec. (Buchler Japan). Data was analyzed using SPSS 21.0 program. ANOVA and Post Hoc HDS Tukey tests were used for statistical analysis. ( p <0.05).

**Results** Statistically significant differences were found between the spiral and pogo groups according to Anova test in terms of surface roughness. (p <0,0001). Significant differences were also noted between Z<sub>250</sub> Ultimate and Z<sub>550</sub> groups using the HDS Tukey test. (p<0.01). Using the Anova test for microhardness, a highly significant difference was determined between 1200 and pogo groups however no significant difference was found with the spiral group. ( p>0.05). Significant differences were found according to the Ultimate and Z<sub>250</sub> ANOVA and HDS Tukey tests. ( p< 0.01). No statistically significant difference was found according to the Z<sub>550</sub> ANOVA test.

**Conclusions** All composite types and polishing systems had a positive effect on surface roughness. A positive effect was observed in all groups in terms of microhardness except Z<sub>550</sub> among the composites and spiral polishing system among the polishing systems.

0089

### **Clinical behavior of direct composite restorations after 12 months using *Adhese Universal***

Huth, S., Enggist, L., Peschke, A., Watzke, R.

Ivoclar Vivadent AG

**Objectives** To evaluate clinical performance of universal adhesive Adhese Universal (Ivoclar Vivadent) in cavity classes I, II using etch&rinse- protocol for direct composite restorations after 12 months.

**Methods** 40 (16 class I and 24 class II) cavities were treated with Adhese Universal using etch&rinse-technique (Fig.1-5: clinical example). Composite fillings were placed with Tetric EvoCeram Bulk Fill (Ivoclar Vivadent) for class I/II (table 1: detailed application protocol ). The restorations were evaluated after 12 months of clinical service concerning their aesthetic, functional and biological properties (FDI criteria). Furthermore a semi-quantitative clinical evaluation-method (SQUACE) was used.

**Results** After 12 months 100% of the restorations, available for evaluation (3 drop-outs), were still in place. All restorations showed FDI grading ranging between excellent and good (table 2). Referring to marginal staining 99.5% of the total margin length (SQUACE) was rated as excellent. Documented marginal flaws (marginal irregularities) affected only small portions of the total margin length (10.9% rated as good, after correction very good). No post-operative sensitivities were reported.

Tetric EvoCeram Bulk Fill showed excellent to good aesthetic results referring surface luster, surface staining and color match. No fractures or cracks of material or tooth occurred.

**Conclusions** The combination of Adhese Universal and Tetric EvoCeram Bulk Fill seems to be reliable to restore class I/II cavities effectively. Although only two universal shades of Tetric EvoCeram Bulk Fill were used, 75% of the restorations showed excellent aesthetics. Due to the effective bonding no postoperative sensitivities were reported and the composite fillings showed excellent margins after 12 months.

0090

## CLINICAL EVALUATION OF MICROHYBRID COMPOSITES IN NON-CARIOUS CERVICAL LESIONS: 24-MONTH RESULTS

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Baskent University, School of Dentistry

**Objectives** The aim of this study was to evaluate the clinical performance of two different microhybrid composite resins in noncarious cervical lesions after 24 months.

**Methods** A total of 97 non-carious cervical lesions were restored with either TPH Spectrum (n=48) or Filtek Z250 (n=49) using an etch&rinse adhesive (Adper Single Bond 2) at 20 patients (12 males and 8 females). The restorations were clinically evaluated using modified USPHS (United States Public Health Service) criteria (retention, color match, marginal discoloration, marginal adaptation, surface texture, anatomic form, postoperative sensitivity and secondary caries) 1 week after placement (baseline) and after 6, 12 and 24 months. The survival rates of restorations were calculated by the Kaplan–Meier procedure estimator and log-rank test was used to compare the survival distributions of these restorations ( $p < 0.05$ ). Statistical analysis was completed using Pearson Chi-square and Fisher's Exact Test for assessing the difference between the restorative materials ( $p < 0.05$ ). Cochran's Q test was also employed for evaluating the difference between recall periods of the same restorative material.

**Results** The recall rate was 100% at each evaluation period. The retention rates were 100% at six months, 89,6 % and 91,8 % at 12-months, 85,4% and 89,8% at 24-months for TPH and Z250, respectively. TPH showed statistically significant difference in marginal discoloration criteria between baseline and 24 months ( $p < 0.05$ ). Both TPH and Z250 showed statistically significant difference in marginal adaptation criteria between baseline and 24 months ( $p < 0.05$ ).

**Conclusions** Over the 24-month period, both microhybrid resin composites (TPH Spectrum and Filtek Z250) demonstrated acceptable clinical results in noncarious cervical lesions.

0091

## Clinical evaluation of silorane and nano-hybrid resin composite restorations in Class II up to 3 years

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**Objectives** This study evaluated the clinical performance of silorane-based resin composite (SC) versus nano-hybrid resin composite (NHC) in Class II restorations.

**Methods** Between January-2012 and February-2013, a total of 29 patients (8 male, 21 female, mean age:  $24 \pm 5$  years old), received 29 pairs of restorations using both SC (Filtek Silorane, 3M ESPE) and NHC (Filtek Z550, 3M ESPE) materials and were followed up until February 2015. Restorations were performed using the corresponding adhesive resins according to the manufacturers' instructions by one operator. Two calibrated independent examiners evaluated the restorations at 1 week, 6 months and thereafter annually using modified USPHS criteria for anatomic form, marginal adaptation, color match, surface roughness, marginal discoloration, secondary caries, post-operative sensitivity and gingival health. The changes in the USPHS parameters were analyzed with McNemar test ( $\alpha = 0.05$ ).

**Results** Mean observation period was 31.2 months. Marginal adaptation was the only parameter that showed the significant difference being worse for SC than that of NHC ( $p = 0.012$ ). At the final recall, 17 restorations from SC and 5 from NHC group received Score 1 (explorer catches). These scores resulted in statistically significant differences between baseline and the final recall for the SC ( $p < 0.001$ ) but not for NHC ( $p > 0.05$ ).

**Conclusions** Both nano-hybrid and silorane-based resin composite performed similar in Class II restorations up to 3 years except for marginal adaptation, where the latter demonstrated significant deterioration at final recall compared to baseline.

0092

### **Clinical Evaluation of a Silorane-Based and a Methacrylate-Based Resin Composite in Class II Restorations: 24-Month Results**

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**Objectives** To compare the 24-month clinical performance of two different composites in Class II slot restorations.

**Methods** Thirty-seven patients (27 female and 10 male) having at least two approximal carious lesions were enrolled in the study. A total of 116 teeth (58 pairs) were restored either with a methacrylate-based packable resin composite, X-tra fil and its self-etch adhesive Futurabond NR (VOCO) or a silorane-based low-shrinkage resin composite, Filtek Silorane and its self-etch adhesive Silorane Adhesive System (3M ESPE,) by tossing a coin. All materials were applied following the manufacturers' instructions. The restorations were evaluated at baseline and at 6-, 12- and 24-month recalls by two calibrated examiners, who were unaware of which resin composite had been used according to the modified USPHS criterias. The survival rates of Silorane and X-tra fil restorations were calculated by Pearson chi square test. The comparison of resin composites for each category was performed with the Cochran Q and Friedman tests. Pairwise comparisons were evaluated by Bonferroni adjusted McNemar's test ( $p < 0.05$ ).

**Results** After 24-month, no statistically significant differences were found between two restorative materials for all evaluated criteria.

**Conclusions** Both Silorane-based and methacrylate-based resin composites showed clinically acceptable performance in Class II slot restorations after 24-month.

0093

### **Comparison of Silorane /Methacrylate-based Composites in Laser/Bur Prepared Cavities**

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**Objectives** To compare the clinical performance of a silorane-based composite with a low-shrinking methacrylate-based nano-hybrid composite in occlusal cavities prepared by Er,Cr:YSGG laser or conventional diamond bur over 12 months.

**Methods** Eighteen patients with four similar-sized occlusal lesions in molar teeth participated to this study. Using a table of random numbers, a total of 72 Class I occlusal cavities were prepared either by Er,Cr:YSGG laser or conventional diamond bur. Cavities were restored with Filtek™Silorane(3M-ESPE) or with Kalore™(GC) according to the manufacturers' instructions. All restorative procedures were performed by one operator and the restorations were examined by two evaluators according to the FDI criteria at baseline and at 6 and 12 months. Patients' satisfaction about the preparation methods was evaluated with questionnaire. Pearson Chi-Square test was used for statistical analyze( $p = 0.05$ ).

**Results** After 12 months, recall rate was 100%. All restorations were scored as 1 for all esthetic properties except marginal staining. Twelve restorations from Laser/Silorane group and 11 restorations from Bur/Silorane group, 15 restorations from Laser/Kalore group and 12 restorations from Bur/Kalore group were scored as 2 for marginal staining. Ten restorations from Laser/Silorane group and 11 restorations from Bur/Silorane group; 15 restorations from Laser/Kalore and 11 restorations from Bur/Kalore group were scored as 2 for marginal adaptation. No significant differences were found among the four groups in marginal adaptation and marginal staining ( $p > 0.05$ ). Only 2 patients(11.1%) reported slight discomfort during laser preparation, whereas 9 patients(50%) were uncomfortable with bur preparation( $p < 0.05$ ).

**Conclusions** Twelve month evaluation of both materials used for the restoration of Er,Cr:YSGG laser or bur prepared Class I cavities exhibited a similar and clinically acceptable performance. Er,Cr:YSGG laser was considered more comfortable and painless compared with bur preparation.

0094

### **Composite Veneers with Different Techniques**

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Ege University School of Dentistry

**Objectives** The objective was to compare the success rate after one year of applied composite veneers different techniques.

**Methods** The participants were selected from volunteer patients of Ege University School of Dentistry. All the subjects were healthy with no periodontal disease history and were caries/restoration free on their anterior teeth. The first 15 teeth were treated with indirect composite veneer with Esthet-X HD (Dentsply DeTrey, USA) and the next 15 teeth were treated with direct composite veneer with Ceram-X Duo (Dentsply DeTrey, USA). Before the preparation, the shades were taken with SpectroShade Micro (MHT Optic Research, Niederhasli, Switzerland) device to be objective. Variolink II (Ivoclar, Vivadent, Schaan, Liechtenstein) was used for luting indirect restorations and PoGo + Enhance (Dentsply DeTrey, USA) were used for polishing. After 6 and 12 months, the restorations were assessed by two observers using modified Ryge criteria. The results were analysed using SPSS 15.0. T test and repeated measures analysis of variance were performed to compare the clinical criterias. P value was set at  $\leq 0.05$ .

**Results** No significant differences were observed among groups at the 6- and 12-month for any of the assessed criteria ( $p \geq 0.05$ ) but marginal discoloration. There was no significant difference between the two materials with respect to anatomic contour, marginal integrity, color match, gross fracture, secondary caries at 12 months ( $p \geq 0.05$ ). Only the marginal discoloration criteria was statistically different between two groups ( $p \leq 0.05$ ). With respect to marginal discoloration direct technique was statistically better than indirect technique ( $p \leq 0.05$ ).

**Conclusions** According to the results of this study, direct and indirect laminate veneer techniques may be a good treatment option for patients with esthetic problems in anterior teeth. However, because of its early marginal discoloration rate and complex technique with luting, indirect techniques would remain a second option.

0095

### **The effect of various pre-treatments to root canal dentine on the push out bond strength of fiber post**

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**Objectives** To evaluate the effect of different pre-treatments such as various irrigation solutions and laser-activated (LAI) technique, to root canal dentine on the push out bond strength (PBS) to fiber post.

**Methods** Sixty freshly extracted mandibular single-rooted premolars were divided into six groups (n=10) according to the final irrigating solution used for the removal of the smear layer, as follows: group N, 5 mL 2.5% NaOCl; group E, 5 mL 17% EDTA; group Q, 5 mL QMIX; group NL, 5 mL 2.5% NaOCl with LAI, group EL, 5 mL 17% EDTA with LAI, and group QL, 5 mL QMIX with LAI. Then, the fiber posts were also covered with a thin layer of a silane agent and dual-cure resin cement was applied on the surface of the fiber post and into the canal space with using a lentulo spiral. All specimens were subjected to PBS test at a crosshead speed of 0.5 mm/min in an apical-to-cervical direction until the post was dislodged. Data were analyzed with one-way ANOVA, Paired-Samples t test and Independent-Samples t test ( $\alpha=0.05$ ).

**Results** There were no statistically significant differences among the groups, regardless of the different levels in all LAI groups. But, there were statistically significant differences were observed among the needle groups, when each irrigation techniques were evaluated separately ( $p<0.05$ ) Furthermore, when the RBS values of the different levels of the dentine were compared within each irrigation groups, the only significant difference was detected for group N (between apical and middle level, between apical and coronal level), group E, group Q and group NL (between coronal and middle level) ( $p<0.05$ ).

**Conclusions** Within the limitations of this study, it can be concluded that LAI technique when used with 2.5% NaOCl, had a significant effect on the amount of bonding between fiber post to root canal dentine.

0096

# **The Effect of Different Post Surface Treatment on the Bond Strength Fiber Posts**

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**Objectives** The aim of the present study was to evaluate the influence of post surface treatment methods on the push-out bond strength of fiber posts.

**Methods** Teeth were decoronated at cemento-enamel junction and instrumented using a set of rotary instrument to the size F3 by the same operator. All teeth obturated with gutta-percha F3 and a resin sealer. The teeth were divided into 3 groups of 10 specimens each. Group 1: No surface treatment as control group, Group 2: A 50-µm aluminum-oxide (Al<sub>2</sub>O<sub>3</sub>) airborne-particle abrasion for 5 s (30-mm distance, 2.5 bar) for each post surface, Group 3: Femtosecond laser. The post space for the largest post size # 3 were prepared with matching drill of the post system. A dual polymerizing resin luting agent was used for cementation of posts. A slow speed diamond saw was used to create 1 mm thickness specimens from each root. Specimens were stored in distilled water at 37° c for 24 h. Then micro push out test was performed on a universal testing machine at a cross-head speed of 1.0 mm/min until bond failure occurred.

**Results** Data were analyzed by 1-way ANOVA. The 1-way ANOVA indicated that push-out test values did not vary significantly according to surface treatments applied ( airborne particle abrasion, femtosecond laser irradiation).

There were no significant differences between the root sections in push-out bond strength of fiber posts (p > 0.05).

**Conclusions** Air-borne particle abrasion or Femtosecond laser irradiation applied on the quartz fiber posts did not affect the push-out bond strengths relative to the root surfaces.

0097

# **Bond Strength of Post and Core Build-up Systems**

Hampe, R., Hader, S., Popp, E., Braun, P., Lachermeier, B., Syrek, A., Peez, R. F., Schwarz, K., Schmid, R.  
3M Deutschland GmbH

**Objectives** Evaluate the effect of macro-retentions in the coronal part of endodontic posts by testing the combination of new bulkfill resin-composite Filtek™ Bulk Fill Posterior (FBP) bonded with Scotchbond™ Universal (SBU) to an experimental fiber-reinforced-composite post (Exp-FP) design with retention elements (w/-R). For comparison a design without retentions (RelyX™ Fiber Post - w/o-R) was used (all materials from 3M ESPE Dental). Moreover, the handling of Exp-FP was assessed by dentists in an in-office test.

**Methods** For the bonding test specially shaped samples were manufactured, with geometries representing the two types of coronal design. The w/-R type reflected the coronal geometry of Exp-FP (Size 3) and w/o-R exactly the coronal geometry of RelyX Fiber Post (Size 3). Bonding surface was treated with SBU. Cylindrical species of FBP around the posts were made (Ø = 5.6 mm, height = 9.8 mm). Cylinder and top-surface were light-cured (LC) for 20s (Elipar™ S10, n=10/group), bond strength tested using a pull-off test method (speed: 1mm/min) and results statistically analysed using the non-parametric Mood Median Test (p<0.05).

**Results** Median bond strength values are summarized below. Groups with no statistically significant difference are marked with the same letter.

The bond strength was significantly higher for the samples with retentions compared to that without retentions. Quantified responses from dentists regarding the handling of Exp-FP indicated high satisfaction level. Dentists appreciated the macro-retentions allow for an immediate depth control and a safe grip with tweezers. FBP can be placed virtually void free around the macro-retentions.

**Conclusions** Overall, both coronal designs showed high bond strength values. Nevertheless, the significantly higher values for samples with macro-retentions might be advantageous for a reliable clinical outcome.

In a clinical environment the handling of the post and core build-up system Exp-FP/SBU/FBP is highly accepted by dentists.

## **Bond Strength Results**

Design	w/-R	w/o-R
Bond Strength [MPa]	20.3 a	17.8 b

0099

### **Assessment of the Fracture Resistance of Endodontically Treated Molar Teeth Restored with Short Fibre Composite, Polyethylene Fibre or Fixed Crown Restoration**

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**Objectives** The purpose of this study was to compare the fracture resistance of endodontically treated molar teeth restored with using composite containing short fibre composite (everX posterior), polyethylene fibre reinforcement and conventional fixed crown restorations in MOD cavities.

**Methods** Seventy-eight molar teeth were selected and assigned to six groups (n=13). Group 1 did not receive any preparation. In the other groups, the teeth were root filled and standard MOD cavities were prepared. Group 2 was left unrestored. Group 3 was restored with a composite (Z250, 3M ESPE, USA) material. In group 4, everX posterior composite (GC, Tokyo, Japan) was placed as a dentin and covered with a composite resin material. In group 5, a polyethylene fibre (Ribbond, Seattle, WA, USA) was inserted into the cavities in a bucco-lingual direction and covered with Z250 composite material. In group 6, the teeth were restored with a composite material and covered with conventional fixed crown restorations. The specimens were stored in 100% humidity media at 37°C degree for 7 days. Each specimen was placed in a universal testing machine and subjected to compressive loading at a crosshead speed of 0.5 mm/min. Data were subjected to analysis of variance (ANOVA) and Tukey post-hoc tests.

**Results** The mean loading values in each group were as follows (N): (Group 1)  $873.54 \pm 140.02^b$ , (Group 2)  $173.14 \pm 76.91^d$ , (Group 3)  $572.41 \pm 147.27^c$ , (Group 4)  $703.31 \pm 217.38^{bc}$ , (Group 5)  $651.37 \pm 271.57^{bc}$ , (Group 6)  $1690.75 \pm 464.06^a$ . There were statistically significant differences between groups showed with different letters.

**Conclusions** Within the limitations of this study, endodontic treatment significantly reduced the fracture resistance of molar teeth. Conventional fixed crown restorations had higher fracture strength than the other restorations. However, the fracture mode of fixed crown restorations were irreparable. For this reason, polyethylene fibre or everX posterior can be used for the coronal restoration of endodontically treated teeth. The clinical significance of this findings must be determined.

0100

### **Effect of load cycling on the fracture strength/mode of root canal treated teeth restored with FRC-posts or FRC-base**

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**Objectives** To comparatively evaluate the fracture strength and failure mode pattern of root canal treated teeth restored FRC-posts or FRC-base plus a particle-filled composite.

**Methods** Intact first upper premolars with two roots, extracted for orthodontic reasons, were distributed into 2 groups (A,B, 2x10 teeth each), with similar premolar sizes in each group. The lingual cusps of all teeth were removed down to cervical enamel. The teeth were subjected to root-canal treatment, provisionally sealed and following 1w-storage (H<sub>2</sub>O/37°C) were restored as follows: Group A: 1) FRC-post luted into lingual canal; 2) enamel acid etching; 3) adhesive treatment (G-Aenial Bond,10s-exp); 3) particle-filled composite application (G-Aenial, 3x2mm increments, 40s-exp each), 4) contouring-finishing-polishing. Group B: 1) Removal of gutta-percha down to 2mm depth from cut cervical enamel; 2) etching and adhesive treatments as above 3) application of a FR composite base (Ever-X, 4mm layer); 4) application of the particle-filled composite (2mm layer); 5) contouring-finishing-polishing. Specimens were immersed in H<sub>2</sub>O (1w/37°C), then subjected to load-cycling (50N/2Hz/200k cycles) and fractured under compressive loading. Failure mode was characterized by stereomicroscopy. Statistical analysis was performed by Mann-Whitney (load) and  $\chi^2$  (mode) at  $\alpha=0.05$ .

**Results** No statistically significant differences ( $p=0.273$ ) were found in fracture load between median values of groups A (860 N) and B (1059 N). In group A, 60% of the specimens demonstrated catastrophic root fractures and 40% mixed fractures (residual tooth crown and restorative material), whereas in group B, no root fractures were found and the failure modes were equally distributed between mixed fractures as above and fracture of the buccal cusp. The differences in mode between groups A and B were statistically significant ( $p=0.004$ ).

**Conclusions** The FR-base composite tested significantly modified failure mode, diminishing the catastrophic root fractures induced by FRC-posts, at a similar fracture load.

0101

### **Fracture strength of severely damaged premolars restored with short-fibre-reinforced, bulk-fill and nano-hybrid composite core build-ups in the absence or presence of fibre-post**

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**Objectives** This study aims to evaluate the fracture resistance of severely damaged endodontically treated premolars restored with short-fibre-reinforced, bulk-fill and nanohybrid composite core build-ups in the absence/presence posts.

**Methods** One-hundred-forty extracted human mandibular premolars were selected for the study. After endodontic treatment, teeth were decoronated at the cemento-enamel junction remaining root length  $\geq 12$  mm except for control group. The sectioned roots surface area were measured for randomization and the roots were divided into nine groups (n=14) according to preparation type (adhesive, 3-mm intraradicular retention, 8-mm fibre-post preparation) and material type (nano-hybrid composite (Filtek™ Z550), bulk-fill flowable (Filtek™ Bulk Fill) and short-fibre-reinforced composite (everX Posterior™)). After 5-mm height chamfer crown preparations, metallic crowns were prepared. Following the cementation procedures, specimens were subjected to compressive load at a strain rate of 1 mm/min. Mode of failure was defined as repairable or non-repairable. Pearson correlation analysis was used to determine a correlation between root surface area and fracture strength values. The fracture data were statistically analyzed using two-way ANOVA and Tukey's test for multiple comparisons.

**Results** While there was a moderate correlation in adhesive and 3-mm retentive groups ( $r=0.61$ ,  $r=0.53$ ), a weak correlation in 8-mm fibre-post group ( $r=0.29$ ). The fracture strength was significantly affected by the preparation and the material type ( $P<0.05$ ). Fibre-post preparation was significantly increased the fracture resistance compared with the others ( $P<0.05$ ). Short-fibre-reinforced composite had significantly higher fracture resistance values ( $P<0.05$ ). Groups restored with adhesive and 3-mm retention preparation techniques presented a higher number of repairable fractures.

**Conclusions** The restoration of severely damaged premolar teeth with use of a fiber-post with any restorative material increases the fracture strength. Although this in vitro study has limitations regarding clinical relevance, the use of short-fibre-reinforced composite in 3-mm retention preparation offers promising results with several advantages over a fiber-post.

0102

#### **Fracture Resistance of Endodontically Treated Roots Restored with Short Fiber-Reinforced Composite, Bulk-Fill Flowable Composite, MTA and Biodentine as Intraorifice Barriers**

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**Objectives** This study aims to evaluate the effect of several materials (glass ionomer cement, composite resin, short fiber-reinforced composite, bulk-fill flowable composite, MTA Angelus, Micro Mega MTA, and Biodentine) as intraorifice barriers on the fracture strength of roots.

**Methods** One hundred-thirty five mandibular premolars were decoronated and prepared up to size #40. Following the standardized silicone layer that simulated the periodontal ligament was created; roots were embedded in acrylic resin. The root canals were filled and randomly divided into two control and seven experimental groups (n=15), as follows: positive control group (the intraorifice barrier cavity was not prepared), negative control group (the intraorifice barrier cavity was prepared, but not filled), intraorifice barrier cavity preparation (3-mm in depth) filled with glass ionomer cement, nano-hybrid composite resin, short fiber-reinforced composite, bulk-fill flowable composite, MTA Angelus, Micro Mega MTA or Biodentine.. The strength test was performed with a universal testing machine using a steel spherical tip with a diameter of 2 mm (perpendicular to the long axis of the tooth) at a constant crosshead speed of 1 mm/min. The data were analyzed using one-way ANOVA and Tukey post-hoc tests.

**Results** Nano-hybrid composite, short fiber-reinforced composite, bulk-fill flowable composite and glass ionomer cement increased the fracture strength of the roots compared to the positive and negative control groups ( $P < 0.05$ ). While MTA groups did not increase the fracture strength of the roots compared to the control groups, Biodentine increased significantly.

**Conclusions** Within the limitations of the present study, the use of short fiber-reinforced composite, and bulk-fill flowable composite have not additional advantage over the composite resin in terms of reinforcing roots. MTA placement (MTA Angelus or Micro Mega MTA) as an intraorifice barrier did not significantly increase the fracture resistance of endodontically treated roots compared to the control groups, however, Biodentine did.

0103

#### **Fracture resistance of endodontically-treated teeth restored with different restorative resins**

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**Objectives** The aim of this in vitro study was to evaluate the fracture resistance of endodontically-treated teeth restored with different types of restorative resins.

**Methods** Seventy-two sound human maxillary premolar teeth were randomly divided into 6 groups (n=12). Teeth in first group left intact and tested as unprepared positive control (Group I). Teeth in the remaining five groups were prepared with MOD cavities and endodontically-treated. The teeth in one of the five groups (negative control-Group II) were unrestored. Rest of prepared cavities were restored as follows; Group III: Bulkfill resin composite/Filtek Bulk Fill (3M/ESPE); Group IV: Bulkfill flowable resin composite + nanoceramic resin composite/SureFil SDR Flow + Ceram X Mono (Dentsply); Group V: Fiber-reinforced composite + posterior resin composite/GCeverX posterior + G-aenial posterior (GC Corp.); Group VI: conventional nanohybrid resin composite/Tetric N-Ceram (Ivoclar/Vivadent). Each restorative material was used with its' respective adhesive system. The restored teeth were stored in distilled water for 24 h at 37°C and then thermocycled (5-55°C, x1000). Specimens were subjected to a compressive load until fracture at a crosshead speed of 1mm/min. The data were analyzed using One-way ANOVA and Tukey HSD test (p<0.05). Fracture modes were also analyzed under stereomicroscope.

**Results** No statistically significant differences were found in fracture resistance values of restorative materials(p>0.05). Sound premolar teeth (Group I) showed significantly higher fracture resistance than the other tested groups(p<0.05). Lowest values were obtained by negative control group (Group II) that were statistically significant than other groups (p<0.05). None of the samples in Group IV (Bulkfill flowable + nanoceramic resin composite/SureFil SDR Flow + Ceram X Mono) showed severe fracture involving tooth structure completely and/or longitudinal fracture.

**Conclusions** The fracture resistance of endodontically-treated teeth restored with either bulkfill resin, bulkfill flowable + nanoceramic composite or fiber-reinforced + posterior composite were not different from conventional resin composite.

0104

#### **EFFECT OF DIFFERENT CUSP REDUCTION DESIGN AND THICKNESS TO FRACTURE RESISTANCE OF ENDODONTICALLY TREATED MAXILLARY PREMOLARS**

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**Objectives** To evaluate the fracture resistance and fracture patterns of cusp-coverage restorations with different cusp reduction designs and thicknesses in endodontically treated maxillary premolars with MOD cavities.

**Methods** 165 intact maxillary premolars were divided randomly into 11 groups: G1-9 (reduction groups with various designs and thickness), G10 (MOD group), G11 (intact). In reduction groups both cusps were reduced with combinations of different thicknesses and designs (Reduction thicknesses were: 1.5, 2.5 and 3.5 mm; reduction designs were beveled, horizontal and anatomic.) In all test groups (G1-10), root canal treatment with additional standardized MOD cavity preparation was applied on teeth. Cuspal coverage and MOD preparations were restored using composite resin. All specimens were submitted to 100.000 cycles with 50 Newton mechanical loading for artificial aging. Then, the specimens were subjected to a compressive load parallel to the long axis of the teeth at a crosshead speed of 0.5 mm/min until fracture. Two-way ANOVA and Fisher's LSD test was used to identify statistical differences. The fractured samples were analyzed to determine the fracture pattern (restorable or non-restorable).

**Results** The mean fracture resistance of all cusp-reduced groups (G 1-9) was higher than MOD group. Increased cusp reduction thickness increased the mean fracture resistance values. G6 (2.5 mm, anatomic, 1110.37 N) and G9 (3.5mm, anatomic, 1085.28 N) was significantly higher than MOD group (G10, 777.17 N); G6, G8 (3.5mm, horizontal, 1039.10 N) and G9 was significantly comparable to the intact-premolar group (G11, 1640.80 N). The highest restorable fracture rates were observed in G6 and G9.

**Conclusions** Cusp reduction design and thickness influenced the fracture resistance and fracture patterns of cusp-coverage restoration of endodontically treated maxillary premolars with MOD cavities. Teeth restored with anatomic cusp reduction design at least 2.5 mm reduction thickness had higher fracture resistance and restorable fractures.

**Fracture resistance evaluation of different post-core systems in-vitro.**Ekren, O.<sup>1</sup>, Basgil, M. C.<sup>1</sup>, Ozpolat, Z.<sup>2</sup><sup>1</sup>CUKUROVA UNIVERSITY, <sup>2</sup>CUKUROVA UNIVERSITY

**Objectives** Restoring excessively damaged teeth is a challenging clinical situation. Endodontic posts (glass and carbon fibers and cast-posts) and cores are used for enhancing retention and resistance. The aim of this study was to evaluate and compare the fracture resistance of post-core systems made of cast Ni-Cr, fiber post and composite core and pressed lithium disilicate post-core systems.

**Methods** Root canal treatment was conducted on collected sound maxillary anterior teeth. After standardization of root length as 10 mm, post space was prepared. A total of 30 teeth were divided into 3 groups (n=10) randomly for Ni-Cr, lithium disilicate and fiber post-composite core. The impression of post space was taken with pattern resin. Following the laboratory procedures, Ni-Cr and lithium disilicate post-core were prepared. Fabricated post-cores and fiber posts were luted with dual-cure resin cement. After 24 hours test specimens were subjected to thermal cycling between 7 °C and 50 °C and were subjected to fracture test with a cross-head speed of 1mm/min. Data were subjected to one-way ANOVA followed by Dunnett T3 tests for statistical analyses ( $\alpha=0.05$ ) using SPSS 21.

**Results** The mean and standard deviation of maximum fracture force were given in Table 1. Teeth which received Ni-Cr post cores had highest fracture resistance however lithium disilicate group had the least. There was no statistically significant difference between cast Ni-Cr and fiber post groups.

**Conclusions** Within the limitations of this study it can be concluded that despite aesthetic advantages lithium disilicate ceramics are not an ideal material for post-core fabrication due to its low fracture resistance.

Table 1

Groups	N	Mean Force $\pm$ Std.Dev (N)
Cast Ni-Cr	10	334.2 $\pm$ 130.5 a
Fiber post	10	280.2 $\pm$ 62.5 a
Lithium disilicate	10	162.8 $\pm$ 28.6 b

**FRACTURE RESISTANCE OF A NOVEL TITANIUM POST**Akman, S.<sup>1</sup>, Akman, M.<sup>2</sup>, Akbulut, M. B.<sup>2</sup>, Belli, S.<sup>3</sup><sup>1</sup>Selcuk University Faculty of Dentistry, <sup>2</sup>Necmettin Erbakan University Faculty of Dentistry, <sup>3</sup>Selcuk University Faculty of Dentistry

**Objectives** The aim of this study was to evaluate fracture strength of a novel titanium post design. This new dental post was designed to minimize stresses at remaining tooth tissues.

**Methods** Fracture resistance testing of the post/core/root complex, fracture analysis were used to post evaluation. Thirty freshly extracted maxillary canin were used and the crowns were removed. The root canals were enlarged to size 45#. The prepared root canals were filled with gutta-percha cones and AH Plus sealer by lateral condensation technique. Filled roots were incubated at 37°C for 1 week under humid conditions. Post spaces were prepared using Parapost drills to a depth of 10 mm. The roots were embedded in a self-curing polymethyl-methacrylate resin and randomly divided into three groups: Group 1: Novel post with two washers, Group 2: Novel post without washer, Group 3: Parapost. Then all posts were cemented with zinc phosphate cement. Composite resin cores were created and the specimens were angle of 45° loaded (1mm/min), the force that was required to fracture each sample was recorded (N) and analyzed (Kruskal Wallis and Mann Whitney-U tests). Fracture types were recorded.

**Results** There was a statistically significant difference among the groups ( $p=0.03$ ). Fracture strengths of Group 1 (718,3 $\pm$ 336,4) was significantly higher than the group 2 (582,5 $\pm$ 158,12) and group 3 (448,9 $\pm$ 152,61). No significant difference was found between the group 2 and group 3 ( $p=0.88$ ).

**Conclusions** Novel post with two washers presented better results fracture strength and repairable fractures.

0107

# **POST-RETENTIVE CORONAL PART CONTRIBUTION TO A DOUBLE FERRULE EFFECT**

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**Objectives** The shape of the coronal part of the post influences the durability of the restoration of root treated teeth. Most of the posts used in the in-vitro or clinical studies have no retention elements in the coronal part.

The purpose of this report was to evaluate the influence of the retentive coronal elements on the in vitro and in vivo behavior of root treated teeth restored with zirconia posts with retentive rings.

**Methods** Different patients and experimental specimens are presented with maxillary central and lateral incisors. The treatment included restoration of root treated teeth with zirconia ceramic posts (cylindrical-conical Y-TZP – (IJS-MF), Ljubljana, Slovenia) with retentive rings in the coronal part, core build ups (IPS E-max press and MultiCore composite) and all ceramic crowns (IPS E-max press).

**Results** The results indicate that the zirconia posts with retentive rings present sufficient aesthetics and fracture resistance when the remaining dentin of root treated teeth is adequately prepared for internal and external ferrule.

**Conclusions** Case selection and treatment choices for post core restorations should be based on a detailed assessment of tooth structure, and the advantages and limitations of dental materials. Current research examining the new design of post and core systems may contribute to a contemporary view on the already in use posts and opens up possibilities to creating a genuine connection between the new ceramic post and core systems with retentive coronal part and the newly designed tooth structure (inner and outer ferrule).

0108

# **A new surface treatment for improving bond strength of veneering ceramics to zirconia framework**

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NIOM

**Objectives** Etching by fluoride compounds may give a rough zirconia surface and improved bond strength to veneering ceramics with less tetragonal to monocline transformation than with sandblasting. An additional silicatization treatment is assumed to give an extra contribution. The purpose of this study was to investigate different fluoride etchants for zirconia and compare bond strength of veneering ceramics with surfaces treated under different conditions.

**Methods** Ninety-six zirconia (Lava Multi XL) specimens were divided into sixteen groups, four were as sintered, four were sandblasted and the rest were etched with two different etchants. Two groups of each category were also silicatized with heat treatment. Two different veneering ceramics, a fluoroapatite glass ceramic (IPS e.max Ceram) and a feldspathic porcelain (Prismatik CZ Porcelain) were fired to the zirconia specimens and the bond strength was measured according to the Schwickerath crack initiation test of ISO 9693-1:2012. Fractions of monoclinic structure were measured by X-ray diffraction after all surface treatments.

**Results** The etching methods made rough surfaces with limited tetragonal to monocline transformation, 0.8 % and 2.8 % for the two etchants respectively, compared to 13.5 % for sandblasting. The following silicatization resulted in increased structural transformation (19.5 and 20.0 %).

Significant higher bond strength was obtained for all silicatized zirconia groups with feldspathic porcelain (36.0 – 45.7 MPa) compared to nonsilicatized groups (29.0 – 29.7 MPa), except for the as sintered and silicatized group (33.2 vs 40.3 MPa). No improvement was obtained with fluorapatite glass ceramics samples and only the as sintered group met the requirements for bond strength (>25 MPa).

**Conclusions** The etching techniques were effective to create rough zirconia surfaces. The combination of etching and silicatization of zirconia gave significant higher bond strength than no etching and silicatization with feldspathic porcelain. No improvement was obtained with fluorapatite glass ceramic veneering.

## Effects of Surface Treatment of Zirconium Oxide Ceramic on Shear Bond Strength to Resin Composite, an In Vitro Study

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**Objectives** This study compares the bond strength of resin cement and yttrium-stabilized tetragonal zirconia polycrystalline (Y-TZP) ceramic with different surface conditioning methods.

**Methods** 80 presintered Y-TZP ceramic specimens were prepared (10 mm diameter, 3mm thickness ) and were randomly assigned to eight groups as control (Group 1, no conditioning); laser (Group 2, Ytterbium laser irradiation treated); sandblasted (Group 3, airabrasion with 50µm Al<sub>2</sub>O<sub>3</sub>); laser and sandblasted (Group 4); acid etching (Group 5, etching with %8 Hydrofluoric acid); laser and acid etching (Group 6); sandblasted and acid etching (Group 7); laser and sandblasted and acid etching (Group 8). After preparation of specimens, composite resin cylinders (Filtek™ Z550, 3M Espe, St. Paul MN, USA) were prepared and were cemented with resin cement (RelyX U 200, 3M Espe, St. Paul MN, USA) on the ceramic surfaces. After that the specimens were kept in an incubator at 36,5 C for 24 hours. All specimens were tested for shear bond strength at an universal testing machine. Two specimens of each group were randomly selected for scanning electron microscopy evaluation. Results monitorized for statistical analysis.

**Results** Statistical analyses of obtained data were evaluated by The Kruskal-Wallis Test and descriptive statistics. Following results were observed: for all tested groups, Ytterbium laser irradiation treated and sandblasted (group 4) showed significantly highest shear bond strength (Values of median was 11,0940) and %8 hydrofluoric acid (group 5) showed lowest (Values of median was 5,3880). At the end of the comparison with the control group, only group 4 showed significant affect on shear bond strength ( $p=0,001$ ).

**Conclusions** This research revealed that shear bond strenght is affected by the surface treatment. Although laser, sandblast and combination treatments shows significant effect on shear bond strength, the acid etching shows no significance.

## INVESTIGATION OF CEMENT&Y-TZP BOND-STRENGTH AFTER DIFFERENT SURFACE TREATMENTS

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**Objectives** The aim of this study compare the bond strength between Y-TZP and five cements following different surface treatment techniques.

**Methods** (2,1×2,1×1 cm) 10 zirconia specimens were prepared for shear bond strength from zirconia blocks (Ava Dent, Italy). First the specimens were divided into five surface treatment groups [control, zr primer, (Z-Prime, Bisco, Schaumburg, Israel), tribochemical silica covering with Rocatec (3M Espe, Germany), covering with AlN (H.C. Stark, Germany), and treating with laser (Fotono, Slovenia)]. Then, divided into five cement subgroups, [Panavia F 2.0 (Kuraray Medical, Japan), Super Bond (Sun Medical, Japan), G-Cem Automix (GC, Japan), Bifix QM (Voco, Liechtenstein), Poly F (Dentsply, Denmark)]. After surface treatment, cement (2mm×3mm) applied to the zirconia surface. All specimens were thermocycled for 5500 cycles between 5°C and 55°C. Shear bond test were performed in a universal testing machine. The bond strengths were recorded and statistically analyzed Shapiro-Wilk , ANOVA, ( $p<0.05$ ).

**Results** The mean SBS (shear bond strength) value for group ROC (16,42±5,59) is the highest bond strength value in all surface treatment groups independent of cement groups ( $p<0.05$ ). Group CON (6,07±9,02) has the lowest value in surface treatment groups independent of cement groups ( $p<0.05$ ). The mean SBS value for group POL (1,93±1,13) is the lowest and for group GC (13,53±7,51) is the highest bond strength value in all cement groups independent of surface groups ( $p<0.05$ ).

**Conclusions** Within the limitation of this in-vitro study for adhesive cementation protocol of zirconia restorations the tribochemical silica coating with Rocatec and using GCem cement is might be an alternative method.

0112

### **Effect of surface treatments and artificial aging on the surface roughness of different Y-TZP ceramics**

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**Objectives** The aim of this study was to evaluate the influence of different surface treatments and artificial aging on the surface roughness (Ra) and morphology of different zirconia ceramics.

**Methods** Four types of zirconia ceramics (Prettau (Pr), Vita In-Ceram YZ (VZ), IPS e.max ZirCAD (IZ) and Lava Zirconia (L)) were used. Seventy bar-shaped specimens for each material (total=280) were prepared and divided into seven groups (n=10) according to the surface treatment and artificial aging used; Control; no treatment (C), Sandblasting (S), Sandblasting+Aging (SA), Grinding (G), Grinding+Aging (GA), Er:YAG laser (L), Er:YAG laser+Aging (LA). Aging procedure included 10000 thermal cycling (5-55 °C) and 100000 mechanical loading (50 N). Roughness was measured with a surface profilometer. Additionally AFM and SEM analysis were carried out. Data were analyzed using ANOVA, Kruskal-Wallis, Tukey HSD and Dunn's/Bonferroni tests ( $p < 0.05$ ).

**Results** Grinding and sandblasting groups showed the highest Ra values compared with the control and laser groups ( $p < 0.05$ ). The differences of the Ra values between the laser and control groups were insignificant ( $p > 0.05$ ). Pr treated with grinding showed the highest, ( $1.34 \pm 0.14$ ) and IZ control group showed the lowest ( $0.24 \pm 0.02$ ) Ra values. Artificial aging did not affect the Ra values compared with the non-aged groups. S and GA groups showed no significant difference among the Y-TZP materials ( $p > 0.05$ ).

**Conclusions** According to the results of this study, sandblasting and grinding surface treatments are useful methods to increase surface roughness of Y-TZP ceramics and short term aging is not effective on the surface roughness of Y-TZP ceramics.

0113

### **Effect of accelerated aging on flexural strength of two yttria-stabilized tetragonal zirconia**

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**Objectives** The objective of the current study was to evaluate the effect of accelerated aging on flexural strength of conventional and translucent commercially available yttria-stabilized tetragonal zirconia polycrystalline (Y-TZP) materials from the same manufacturer

**Methods** Forty thin bars ( $22 \times 3 \times 0.3$  mm) of green stage Y-TZP, 20 from conventional Cerec inCoris ZI (ZI) and 20 from translucent zirconia Cerec inCoris TZI (TZI), were sintered according to manufacture instructions. Ten specimens from each material were evaluated after sintering. The remaining ten specimens were artificially aged at standard autoclave sterilization conditions  $134^\circ\text{C}$  at 0.2 MPa for 5 hours (AZI, ATZI). Tetragonal to monoclinic transformation due to accelerated aging was measured with X-ray diffraction (XRD) for 3 specimens from each group. The flexural strength of the specimen was determined by -3 point bending test in a universal testing machine. Before each measurement, specimen dimensions were measured with a digital caliper with minimum thickness  $0.3 \pm 0.01$  mm. Mean values of flexural strength (MPa) were calculated. Data were analyzed as a function of material and aging. Two-way ANOVA test was used to compare the mean flexural strength of the aged specimens with that of the non aged ones

**Results** The mean value of the flexural strength  $\pm$  SD were:  $1515 \pm 101$  MPa (ZI),  $1405 \pm 78$  MPa (TZI),  $1355 \pm 88$  MPa (AZI), and  $1345 \pm 70$  MPa (ATZI). The XRD peak intensities before aging showed that there was no monoclinic phase detected in both types of zirconia. After aging, the relative XRD peak intensities showed that there was a monoclinic transformation in both types where the ZI specimens showed 80.4 % monoclinic phase and the TZI specimens showed 51% monoclinic phase

**Conclusions** Accelerated aging caused a decrease in flexural strength of the two used types of zirconia with the degree of monoclinic transformation, and hence the decrease in flexural strength, was less in TZI than that of ZI

0114

**The effect of resin cements and titanium base on the transparency of zirconia core material**

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**Objectives** The purpose of this study was to evaluate the effect of different color of resin cements and zirconia cores on the transparency of the restoration that simulates the implant supported fixed prosthesis by using titanium base on the bottom.

**Methods** Zirconia core plates (Zr-Zahn) (10mm in width, 5mm in length and 0.5mm in height) were prepared in A2 shades(n=11). Resin cement plates (3MESPE)(10mm in width, 5 mm in length and 0.4 mm in height) were prepared in A2, A1, TR shades(n=11). The initial color measurements and transparency(TP) were measured on zirconia core plates and resin cements plates using a spectrometer. Then the resin cement plates were placed below the zirconia core plates and second measurements were done. The final measurements were done after placing the titanium discs (5mm in diameter and 3mm in height) in the bottom. The data were analyzed with two way analysis of variance and Tukey's honestly significant differences tests ( $\alpha=0.05$ ).

**Results** The highest TP values were recorded for A1 colored resin specimens, the lowest for zirconia core plates in the first measurement ( $p<0.05$ ). The highest TP value was recorded for A1 colored resin cement with zirconia core plates and the lowest for A2 and TR with zirconia core plates after second measurements ( $p<0.05$ ). The addition of titanium decreased the TP of the zirconia core plate and resin cement combination ( $p<0.05$ ). There were no statistically significant differences in TP values among the different colored resin cements when titanium was added as base material ( $p>0.05$ ).

**Conclusions** The resin cement and the presence of titanium and the zirconia are important factors that determine the final shade of zirconia cores in implant supported fixed prosthesis.

0116

A study on topographical properties and surface wettability of monolithic zirconia after use of diverse polishing instruments with different surface coatings

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**Objectives** Improper surface finishing of fixed dental prosthesis (FDP) made of monolithic zirconia (MZ) may cause opposing enamel wear. This study investigated the surface topography parameters and wettability of MZ using polishers with different coatings and sequences.

**Methods** MZ specimens (N=50, n=10 per group) (Katana Zirconia HT) (12x12x1.8 mm<sup>3</sup>) were polished and randomly allocated to 5 groups, namely BG: Silicone carbide polishers (Brownie, Greenie, Super Greenie); CG: Diamond impregnated ceramic polisher (Ceragloss); EV: Synthetically bonded grinder interspersed with diamond (EVE Kit); SL: Urethane coated paper with aluminium oxide grits (Soflex Kit) and DB: Diamond bur (8  $\mu$ m, FG9205/6). After roughening and baseline measurement, each polishing step was performed for 10 s. A custom made device (750 g load, 5.000-30.000 rpm) was produced for polishing procedures. Topographical changes were evaluated considering a) Weight (Digital scale), b) Volume loss (Digital microscope), c) Vertical height loss (Digital Microscope), d) Surface roughness (Profilometer) and e) Surface wettability (Goniometer). Data (5 levels:  $\Delta W$ ,  $\Delta V$ ,  $\Delta VH$ ,  $\Delta Ra$ ,  $\Delta SW$ ) for polishing regimens (BG, CG, EV, SL, DB) were analyzed using one-way ANOVA, post-hoc Scheffé and Wilcoxon tests. Correlation coefficients were calculated using regression analysis with linear correlation ( $\alpha=0.05$ ).

**Results** Surface material loss after polishing compared to baseline ( $\Delta W$ ) ranged between  $-3\pm0.1\times10^{-4}$ - $296\pm8\times10^{-4}$  g in ascending order as follows:  $SL^a<CG^a<BG^a<DB^b<EV^c$ , volume loss difference ( $\Delta V$ )  $-0.158\pm0.03\times10^{-6}$ - $0.245\pm0.07\times10^{-6}$  mm<sup>3</sup> ( $SL^a<BG^a<CG^{a,b}<DB^b<EV^c$ ), vertical height loss ( $\Delta VH$ )  $-18.91\pm3.52$ - $55.19\pm6.26$   $\mu$ m ( $SL^a<BG^a<CG^{a,b}<DB^b<EV^c$ ), surface roughness ( $\Delta Ra$ )  $-0.143\pm0.015$ - $0.855\pm0.419$   $\mu$ m ( $DB^a<BG^a<SL^a<CG^a<EV^b$ ) and contact angle ( $\Delta SW$ )  $-3.93\pm0.79^\circ$ - $2.79\pm3.14^\circ$  ( $BG^a<DB^a<SL^a<CG^a<EV^a$ ).

**Conclusions** All polishing instruments performed similar when  $\Delta Ra$  values are considered, indicating that monolithic zirconia could not be polished ideally with the tested polishing regimens. After 40 s of polishing, SL, BG and CG performed similar, producing the least material loss of the MZ tested. Synthetically bonded rubber bur interspersed with diamond (EV) could not be suggested for polishing monolithic zirconia.

0117

**Evaluation of dual-cure polymerization under thick monolithic zirconia restorations**

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**Objectives** The aim of this study was to investigate the influence of thickness of the monolithic zirconia material on polymerization efficiency of dual-cure resin cements.

**Methods** Three ceramic discs (4.0 mm diameter) with thicknesses of 2.0, 2.5 and 3.0 were prepared in the Zirkonzahn CAD/CAM system using monolithic zirconia blanks. Two dual-cure resin cements were used: Panavia F 2.0 and DuoLink Universal. For each resin cement, ten samples were prepared for each thickness using a teflon mold and 60 resin cement samples were obtained. Light activation was performed for 20 seconds, using a light emitting diode (LED) curing device with irradiance of 1200 mW/cm<sup>2</sup>. Vickers hardness measurements were conducted. The indentations were made in the cross sectional area at four depths, and the mean values were recorded. Results were statistically analyzed with two-way ANOVA and LSD test ( $p < 0.05$ ).

**Results** A statistically significant decrease in VHN were observed with increasing depth and thickness of the monolithic zirconia discs for each resin cement group ( $p < 0.05$ ). Panavia F 2.0 samples displayed significantly higher decrease in hardness compared to DuoLink Universal samples for 2.0 and 2.5 ( $p < 0.001$ ). Under 3.0 mm discs Panavia F 2.0 samples did not completely polymerize.

using a light emitting diode (LED) curing device with irradiance of 1200 mW/cm<sup>2</sup>. Vickers hardness measurements were conducted. The indentations were made in the cross sectional area at four depths, and the mean values were recorded. Results were statistically analyzed with two-way ANOVA and LSD test ( $p < 0.05$ ).

**Conclusions** Dual-cure resin cements can be used for cementation of monolithic zirconia restorations, however under thicker restorations light attenuation may affect the polymerization negatively. Clinicians may consider dual-cure resin cements with higher amount of self-curing capabilities.

.0 samples did not completely polymerize.

using a light emitting diode (LED) curing device with irradiance of 1200 mW/cm<sup>2</sup>. Vickers hardness measurements were conducted. The indentations were made in the cross sectional area at four depths, and the mean values were recorded. Results were statistically analyzed with two-way ANOVA and LSD test ( $p < 0.05$ ).

0118

**Influence of hydrothermal aging on the optical properties of a translucent zirconia for anterior teeth**

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**Objectives** To evaluate low temperature degradation effects on biaxial flexural strength (BFS), optical properties and microstructure of a translucent zirconia for anterior teeth (ZMA), a translucent zirconia for posterior teeth (ZMP) and zirconia for frame (ZF)

**Methods** Specimens with 12 mm of diameter and 1.2 mm of thickness shaped from a framework and tow monolithic zirconia blocks were subjected to one of the following treatments: aging in water steam at 120° C for 8 hours under 2 kgf/cm of pressure, and no treatment (control)(n=12). Before and after hydrothermal aging, spectral reflectance light data were recorded from 400 to 700 nm spectrum at 10 nm intervals, under the D65 standard illuminant, 2° observer and 37°C of temperature using a computer-controlled spectrophotometer (CM-2600d, Konica Minolta).

Optical properties of opacity, translucency and sum of scattering and absorption were determined since color coordinates of  $L^*$  (lightness),  $a^*$  (red-green chromaticity index),  $b^*$  (yellow-blue chromaticity index),  $C^*$  (chroma) and  $h$  (hue angle). The specimens were subsequently loaded to fracture by means of biaxial bending test (ISO 6872:2008). Specimens microstructure was analyzed by scanning electron microscopy examination before and after hydrothermal aging, and the mean grain area was measured by ImageJ software (n=3).

**Results** The 2-way-ANOVA for BFS was significant, and Tukey test showed that the ZMA was less resistant then ZF and ZMP. Hydrothermal aging affected ZF and ZMA only. SEM images showed expanded grains and empty spaces after hydrothermal aging, and significant increase on grain volume for the all types of zirconia studied. The optical properties were not changed by hydrothermal aging. ZMA had lower opacity (%) and higher translucency and scattering/absortion, while ZMP and ZF did not differ each other.

**Conclusions** Hydrothermal aging apparently interfered on the mechanical resistance and microstructure, but did not significantly affected optical properties.



0119

**The effect of different types of cements on the final color of monolithic zirconia**

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**Objectives** This study was conducted to evaluate the colour changes, in terms of perceptibility and acceptability, in monolithic zirconia and cement combination resulting from the use of two different thicknesses of the monolithic zirconia and three different types of cement. The translucency parameters of these combinations were also compared.

**Methods** A total of 60 monolithic zirconia ceramics at two different thicknesses (0.6mm and 1mm) were milled. Three different types of cement (conventional glass ionomer cement, resin-modified resin cement and adhesive resin cement) were selected for cementation. (n=10) Translucency and color changes of monolithic zirconia specimens after cement application were examined with spectrophotometer (Konica Minolta Sensing, Japan) and translucency parameter (TP) and color change ( $\Delta E$ ) were calculated. Statistical analysis was performed using One-way ANOVA, TUKEY multiple comparison test, and independent samples t test.

**Results** All luting cements studied, regardless of the type, caused color difference both at 0,6 and 1 mm thicknesses of monolithic zirconia. The lowest  $\Delta E$  values (3,53 ; 2,23 for 0,6 and 1mm respectively) were found for zirconia-resin modified glass ionomer combination whereas the highest  $\Delta E$  values (5,64 ; 5,06 for 0,6 and 1mm respectively) were observed for zirconia-resin cement combination at both thicknesses. Glass ionomer cement affected the TP values the most for both thicknesses.

**Conclusions** Cement type and material thicknesses affect final color and translucency of monolithic zirconia restorations.

0122

**Therapeutic Effects of Sildenafil on Experimental Mandibular Fractures in Rats: an Immunohistochemical and Histomorphometric Study**

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**Objectives** There is no study about the effect of sildenafil on fracture healing. This study was designed to investigate the effect of sildenafil on fracture healing process.

**Methods** Thirty-six female Sprague-Dawley rats (3 month old) were used in this study. Animals were divided into 2 groups randomly, and each group was divided into two as control(C) and study(S) groups. Group C(C1, C2) treated with saline solution and group S(S1,S2) were treated daily with 10mg/kg body weight sildenafil. Histologic, histomorphometric, radiological and immunohistochemical analysis at 1 week and 4 weeks after fracture were performed.

**Results** The sildenafil treated group showed an increase in fracture healing scores, with statistically significant (p=0.00). We observed transition of fibrous callus to cartilage callus and immature bone tissue in the group S1 and increased transition of cartilage callus to completely immature bone callus, in the group S2 which sildenafil had been given. The strong expression of BMP-2 and col-1 was observed in the fibrous matrix and osteoblasts within areas of new bone formation especially in the group S1. The group showed an increase in bone density measurements at 1 week with statistically significant (p=0.03).

**Conclusions** Sildenafil accelerates fracture healing and it can be used as a supporting factor in improvement of fracture healing in various conditions.

**0126**

**Double delivery of bone morphogenetic proteins (BMPs) and epigenetically active small chemicals by calcium and titanium based scaffolds produced by additive manufacturing.**

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**Objectives** The treatment of large bone defects still poses a major challenge in orthopaedic and cranio-maxillofacial surgery. The aim of this study was to determine the osteoconductive potential of titanium and calcium phosphate based implants generated by additive manufacturing and the application of these scaffolds with osteoinduction by BMP and epigenetically active small chemicals via an in situ forming degradable implant.

**Methods** Defined implants were produced by additive manufacturing and tested in calvarial defects in rabbits and compared to untreated defects. In the last series a critical size defect treated with SLA produced titanium based implants as such or doped with BMP or BMP and epigenetically active small chemicals.

**Results** Analysis by  $\mu$ CT and histomorphometry revealed that all generatively produced structures were well osseointegrated into the surrounding bone. The histomorphometric analysis, based solely on the middle section, revealed that bone formation was significantly increased in all implant treated groups compared to untreated defects. In the critical size defect, the scaffold alone was sufficient to yield defect bridging after 16 weeks. Addition of BMP and epigenetically small chemicals was able to increase the area of osseous regeneration when delivered with a faster degrading polylactide-glycolide polymer used to generate an in situ forming implant.

**Conclusions** Designed porous, lightweight structures have potential for bone regeneration and augmentation purposes, especially when complex and patient-specific geometries are essential. The combination of the osteoconductive scaffold with osteoinductive BMP and epigenetically small chemicals show effect solely in a fast degrading composition of the in situ forming implant.

**0127**

**Effectiveness of Chlorhexidine in the prophylaxis of alveolar osteitis. Meta-analysis**

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**Objectives** To test the effect of Chlorhexidine on reducing the incidence of alveolar osteitis following tooth extraction

**Methods** Design: Systematic review and meta-analysis. Data sources: Pubmed, Cochrane, Science Direct, and ISI-Web-of-knowledge. Searched up to 17 January 2015 (chlorhexidine) AND (alveolar osteitis OR dry socket) AND (exodontia OR extraction OR removal) were used as key words for title and abstract. References of each article were also reviewed. Meeting Abstracts published were searched. We only included randomized controlled clinical trials using chlorhexidine. There were no restrictions regarding language or date of publication. The outcome measure was set on incidence of alveolar osteitis after tooth extraction. There was no restriction on the definition of alveolar osteitis. Any specific adverse effects related to chlorhexidine were reported. Three review authors independently undertook risk of bias assessment and data extraction. We followed the recommendations proposed by PRISMA. We used the statistical program Stata version 12.0. The statistical technique was meta-analysis of binary data using fixed-effects models. We estimated risk ratios (RR) and 95% confidence intervals (CI). We made Forest, Labbe and Funnel plots

**Results** Out of 25 studies, eighteen eligible trials with 2824 extractions were considered, 1458 in the experimental group and 1366 in the control group. The chlorhexidine treatment is effective in the prevention of dry socket. The overall risk ratio (RR) is 0.66 with a 95% confidence interval (CI) of 0.59 to 0.77. The RR was statistically significant  $p < 0.001$ . There is no evidence of heterogeneity:  $I^2 = 24\%$ , chi-squared test  $p = 0.147$ . Chlorhexidine did not cause higher adverse reactions than placebo

**Conclusions** There is evidence to support the use of chlorhexidine to reduce the incidence of alveolar osteitis following tooth extractions. It would be necessary to treat with chlorhexidine between four and seven patients (95% CI of the overall NNT) to prevent one case of dry socket

0128

**Chlorhexidine for reducing bacteremia following dental extraction. Meta-analysis.**

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**Objectives** To test the null hypothesis of no difference in the incidence of bacteremia following dental extractions for patients being treated with or without chlorhexidine.

**Methods** Design: Systematic review and meta-analysis. Data sources: Pubmed, Cochrane, ISI Web of Knowledge and Science Direct. Searched up to 31 December 2014. Chlorhexidine AND Bacteremia AND “exodontia OR dental extraction OR dental removal” were used as key words in a free-text search. References of each article were also reviewed. Meeting Abstracts published were searched. We only included randomised placebo-controlled clinical trials using chlorhexidine. There were no restrictions regarding language or date of publication. The outcome measure was set on incidence of bacteremia measure within the first ten minutes after the extraction. There was no restriction in the assessment method. Any specific adverse effects related to chlorhexidine were reported. Two review authors independently undertook the risk of bias assessment and data extraction. We followed the recommendations proposed by PRISMA. A fixed-effect inverse variance weighted metaanalysis was conducted using Stata software 12.0. Results are presented as risk ratios (RR) with 95% confidence intervals. We made Forest, Labbe and Funnel plots.

**Results** Out of 18 studies, seven eligible trials with 421 participants were selected, 217 in the experimental group and 204 in the control group. There was evidence for the effectiveness of using pre extraction 0.12% or 0.2% chlorhexidine compared to placebo with a risk ratio (RR) of 0.88 (95% confidence interval (CI) 0.79 to 0.97; P=0.01, but with no evidence of heterogeneity  $I^2=23.4\%$ . chi-squared test  $p=0.25$  Chlorhexidine did not cause higher adverse reactions than placebo.

**Conclusions** There is a reduction of 12% in the bacteremia following dental extractions for patients being treated with chlorhexidine; however, further high-quality randomised control trials are needed.

0131

**ESWT accelerate bone healing in mandible defect treated with ceramic graft: An experimental study in diabetic rats**

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**Objectives** The aim of this study was to evaluate the effect of the extracorporeal shock wave therapy (ESWT) on healing of critical size bone defects filled with ceramic graft in diabetic rats.

**Methods** 20 male wistar rats that average weight is 220 gr were used in this study. All animals were randomly divided into two groups, non-diabetic group ( $n=10$ ) and diabetic group ( $n=10$ ). Diabetes mellitus was induced in diabetic group by intraperitoneal injection of 50 mg/kg Streptozotocin prior to surgery. Four mm critical size defects were created on mandible ramus in all rats and filled with ceramic graft (Bone Ceramic, Straumann). ESWT was performed to half of rats in each group on 3th, 5th and 7th days after surgery. Each ESWT session consisted of 200 impulses at 0,18 mJ/mm<sup>2</sup> energy flux density. The rats were sacrificed after a healing period of 2 months.

Stereological study was performed of the mandible samples following digital image analysis.

**Results** Statistical evaluation was performed separately for each group. According to the stereological study, newly formed bone (NB) and connective tissue (Cot) volumes were statistically higher in ESWT applied rats compared to the non-applied rats in diabetic group, respectively ( $p=0,000$ ) ( $p=0,000$ ). Neovascularization (NV) volume was also greater in ESWT applied rats with diabetes, but it was not statistically significant. In non-diabetic group, significant increasing in Cot ( $p=0,003$ ) and NV ( $p=0,018$ ) volumes were noted in ESWT applied rats compared with non-applied rats, but no significant increasing in NB volumes. Radiological examination was carried out by measuring the Hounsfield unit values in defect areas. In ESWT applied subgroups, Hounsfield units values founded were higher than ESWT non-applied subgroups in also diabetic and non-diabetic groups, but the differences were not significant.

**Conclusions** These results indicate that the ESWT therapy influences bone regeneration and accelerates the healing of bone defects filled with ceramic bone graft in both diabetic and non-diabetic rats.

0133

**Clinical and Radiographic Comparison of Bovine Derived Xenograft versus Collagenated Xenograft.**

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**Objectives** The purpose of the present study was to compare the clinical and radiographic effectiveness of a bovine derived xenograft (BDX) versus collagenated xenograft application in the treatment of intrabony periodontal defects of advanced chronic periodontitis patients.

**Methods** Twenty advanced chronic periodontitis patients with the mean age of 45.25±9.82 who had radiographic intrabony defects with an associated probing depth (PD) of ≥ 5 mm and an intrabony component of ≥ 3 mm were included in the present study. A total of 108 intrabony defects were treated. While 55 of these defects were surgically treated with BDX (1<sup>st</sup> group), the other 53 were treated with collagenated xenograft (2<sup>nd</sup> group). Prior to and 12 months after surgery, plaque and sulcus bleeding indices, PD, marginal recession, relative attachment, probing bone and radiographic bone levels were recorded.

**Results** Healing was uneventful in all cases. At 12 months postoperatively, intragroup comparisons for all evaluated clinical and radiographic parameters revealed statistically significant differences compared to baseline (p<0.05).

Considering the deepest site of the defects, group 1 and 2 showed a mean PD reduction of 3,05±0,78 mm and 3,35±0,62 mm, attachment gain of 2,36±0,58 mm and 2,58±0,86 mm, recession of **0,69±0,55mm and 0,76±0,64 mm**, clinical bone gain of 2,13±0,66 mm and 2,19±0,95 mm and radiographic bone gain of 1,82±0,92 mm and 2,23±0,69 mm, respectively. Intergroup group comparisons for all parameters were insignificant (p>0.05).

**Conclusions** Within the limits of this study, it can be concluded that both BDX and collagenated xenograft treatments lead to significantly favourable clinical improvements in intrabony periodontal defects compared to baseline. No statistically significant differences in any of the investigated parameters were observed between the two groups.

0134

**In vitro-activity of photoactivated disinfection using LED light in the blue spectrum against periodontopathogens**

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**Objectives** Light in the blue spectrum is well known to cure composite materials based on camphorquinone as photoinitiator. This in vitro-study was aimed to analyze a potential antimicrobial activity when combined with riboflavin as a photosensitizer.

**Methods** Photoactivated disinfection (PAD) using an LED lamp emitting in the blue spectrum for 30 s (PAD30) and 60 s (PAD60) after application of 0.1% riboflavin was compared with a LED lamp emitting in the red spectrum with the respective photosensitizer (PADred). Killing activity was analyzed against planktonic 14 single species and a 12-species mixture with and without 25% serum. In addition, reduction of viable bacterial counts in single species and a 12-species biofilm was measured after PAD.

**Results** Gram-positive bacteria were less sensitive to PAD30 and PAD60 than Gram-negatives. PAD60 decreased the counts by more than 3 log<sub>10</sub> cfu in two of five Gram-positive and six of nine Gram-negative strains, the total viable counts of the mixture were reduced by 1.04 ± 0.46 log<sub>10</sub> cfu. In the presence of 25% serum PAD60 did not reduce the cfu counts by more than 3 log<sub>10</sub> cfu; a decrease by more than 2 log<sub>10</sub> cfu was only found in tests with *Porphyromonas gingivalis* ATCC 33277. PADred killed all included strains except for the 12-species mixture and *Eubacterium nodatum* ATCC 33099. PAD60 reduced the counts in *P. gingivalis* biofilms by 2 – 3 log<sub>10</sub> cfu, however there was no activity of PAD60 and PADred on the multi-species biofilm.

**Conclusions** PAD using LED emitting in the blue spectrum combined with riboflavin is active against planktonic periodontopathic microbial species even in the presence of serum and in single-species biofilms. An elimination of multi-species biofilms appears to be impossible thus underlining the importance of mechanical biofilm removal prior to treatment.

0135

**EFFECTS OF ENERGY DRINKS ON SOFT TISSUE WOUND HEALING IN DIABETIC RATS**

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**Objectives** Wound healing mechanism consists of a period that has been started following injury of tissue and finished when tissue is healthy again and this process is affected by systemic, local and environmental factors. Wound healing process in the presence of systemic diseases, such as, diabetes are getting more challenging. In addition taking of specific nutrients while healing process accelerates wound healing. Aim of this study is to evaluate sugar-free energy drink on the soft tissue wound healing in diabetic rats clinically.

**Methods** 72 Wistar albino rats used and randomly assigned into control(n=36) and test group(n=36). Animals were fed with high calorie diet and intraperitoneal injection of streptozotocin to create type 2 diabetes. Two surgical wounds each of 3mm diameters on the same horizontal plane was created in palatal tissue. The first wound edge marked with punch and deepithelialization achieved by scalpel in the posterior side. The second wound created in the 3 mm anterior region of the first wound and removed total 3 mm of epithelium and connective tissue with exposed of bone tissue. Intraoral photographs of rats taken after operation. Energy drink(ED) in the test group and distilled water(DW) in control group via oral gavage administered. Clinical evaluation was made on the 3rd, 7th and 14th days for each group. Diameter measurements were made of the wound surfaces with Williams probe after sacrifice. The same time, photos taken with same angle and clinical inflammation parameters such as edema and erythema assessed.

**Results** In terms of improvement of erythema and deepithelialization results revealed that test groups (ED) statically significant better than control group (DW) on the 3rd day. No statically significant difference between two groups was detected in other parameters and other parameters and other time interval.

**Conclusions** It can be concluded that energy drinks have a better clinical effect on early phase of wound healing.

0137

**One subgingival irrigation with 10% povidone iodine after root planning**

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UCL

**Objectives** The effects of antiseptics in the treatment of periodontitis are well documented. The goal of this study was to evaluate the efficacy of a unique subgingival irrigation of 10% povidone iodine after a full mouth scaling and root planning treatment in chronic periodontitis.

**Methods** Twenty patients with chronic periodontitis took part in this investigation. In each patient four initially untreated pockets  $\geq 4$ mm were randomly selected for one subgingival irrigation. After a full mouth treatment of scaling and root planning, two pockets of this split mouth design received one unique irrigation of 10ml 0.9% NaCl (control group). Two pockets in the other side received 10ml of povidone iodine 10% (test group). Measures of PPD, CAL, BOP, PII, and GI were registered at M0 and after M1, M3 and M6.

**Results** PPD, CAL and BOP improved significantly in both groups after six months. The major difference was seen between M0 and M3. No significant differences were observed between the control and test groups.

**Conclusions** No statistical differences were seen between the NaCl and PVI groups in the clinical results after six months. More studies are needed to confirm these results. Further prospective studies in which multiple irrigations of povidone iodine 10% will be given, for example at each control, could enhance this periodontal treatment.

0138

The Influence of Non-surgical Periodontal Treatment on Circulating Markers of Inflammation in Subjects with Type 2 Diabetes and Chronic Periodontitis: The Diabetes And Periodontal Therapy Trial

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**Objectives** Chronic periodontitis and type 2 diabetes are associated with increased risk for cardiovascular disease. Some evidence suggests that periodontal therapy may reduce circulating markers of inflammation. The purpose of this study was to test whether non-surgical periodontal treatment influenced circulating biomarkers associated with cardiovascular disease in persons with type 2 diabetes (DM) and moderate to advanced chronic periodontitis.

**Methods** The Diabetes and Periodontal Therapy Trial (DPTT) was a 6-month, single-masked, randomized, multi-center clinical trial. The treatment group (n=257) received scaling and root planing, oral hygiene instruction, and

chlorhexidine oral rinse at baseline and periodontal maintenance therapy at three and six months. The control group (n=257) received delayed treatment after the six month study period. Blood samples were collected at baseline, and six months and analyzed for a panel of pro- and anti-inflammatory biomarkers: HS-CRP, E-Selectin, TNF-alpha, VCAM, IL-6, IL-8, ICAM, and IL-10. Correlation between biomarkers, diabetes related variables, and periodontal disease measures were explored, and change from baseline of biomarkers were compared between treatment and control groups.

**Results** Among all biomarkers at baseline, E-selectin, was significantly associated with HbA1c, BMI, fasting glucose, and fasting insulin while IL-6 was significantly correlated with HS-CRP, BMI, and E-selectin. No significant correlations between periodontal measures and biomarkers were noted at baseline or after therapy. Periodontal disease measures were significantly improved at six months, while diabetes outcomes and circulating biomarkers showed no significant change.

**Conclusions** Non-surgical periodontal therapy did not result in significant changes to serum biomarker profiles in patients with type 2 diabetes and moderate to advanced chronic periodontitis.

**0139**

### **Interdisciplinary Treatment for a Two Patients with Amelogenesis Imperfecta**

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**Objectives** Amelogenesis imperfecta (AI) is an autosomal recessive disorder which cause developmental alterations in the structure of enamel, further complicate the quality of life by causing oral health and physiologic problems. Amelogenesis imperfecta may have different inheritance patterns depending on the gene that is altered. The treatment used depends on the severity of the problem. Crowns are sometimes used to improve the appearance of the teeth and protect them from damage. This case series describes the functional and esthetic rehabilitation of AI with interdisciplinary approach.

**Methods** This case reports deals with the interdisciplinary approach of a 23-year-old male patients and his sisters who is 16 years old with AI of the hypoplastic type. The patients came with severe sensitivity of teeth, chewing difficulties, esthetic and physiologic problems. Medical history does not exhibited any systemic disease or smoking condition . Intraoral examination revealed that yellow-brown coloured teeth, generalized attrition, loss of clinical crown length, diffuse gingival enlargement and vertical dimension in both patients. Radiological and cone-beam examination revealed generalized loss of enamel structure and multiple impacted teeth that close relationship between mandibular canal.

The treatment procedures involved prosthodontic and periodontologic interventions. Before the surgery periodontal treatments were completed and all pockets were eliminated. After the initial periodontal therapy, crown lengthening were performed with respect to the all of the teeth and crest was smoothed in edentulous area. Finally the rehabilitation included all-ceramic crowns on anterior teeth and metal-ceramic crowns on posterior teeth following crown-lengthening procedure for eliminating tooth sensitivity, improving the aesthetics and restoring function.

**Results** As a result of the treatment aesthetic, functional and psychosocial problems were achieved in the two cases. After 6 months of treatment any periodontal or prosthetic complications were not observed.

**Conclusions** 6 months follow-up revealed satisfactory results and no deterioration in the restorations.

**0140**

### **Advanced Platelet-Rich Fibrin in the treatment of bilateral multiple gingival recessions**

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**Objectives** The treatment of gingival recession is considered a challenge in periodontal practice, and among the different techniques used, autogenous subepithelial connective tissue graft (SCTG) has shown the most favorable results, but this technique has some disadvantages.

Platelet rich fibrin (PRF) is a fibrin scaffold derived from the patient's own blood after one centrifugation step. Recently a new concept PRF have developed that called Advance Platelet Rich Fibrin (A-PRF) . Densite of A-PRF is higher than standart PRF. It might more effective soft tissue regeneration because of the A-PRF contains a large quantity of monocytes/macrophages and their growth factors.

The objective of this case series were to evaluate the clinical effectiveness of A-PRF in combination with modified coronally advanced flap (MCAF) in the treatment of multiple gingival recessions.

Methods 5 systemically healthy patients with bilateral multiple buccal Miller Class I-II recession defects were treated in this case series. A total number of 30 defects received either A- PRF+MCAF or MCAF with SCTG. Gingival recession depth (RD), gingival recession width (RW), keratinized tissue width (KTW), recession area (RA), probing depth (PD), clinical attachment level (CAL) and gingival thickness (GT) were evaluated at baseline and after 6 months. Additionally, patient's discomfort were measured by comparing visual analogue scale scores. Results Both methods were effective in providing a significant reduction of the baseline. KTW and GT were increased and RD decreases in both groups from baseline to 6 months ( $p < 0.001$ ), but there were no statistically significant difference between treatment groups ( $p > 0.05$ ). Use of a A-PRF membrane in gingival recession treatment decreased postoperative discomfort compared to SCTG-treated gingival recessions. Conclusions We conclude that localized gingival recessions could be successfully treated with MCAF+A- PRF as well as MCAF+SCTG. The PRF technique has a bonus advantage of being more comfortable during postoperative period.

#### 0141

##### USE OF LOW LEVEL LASER THERAPY FOR NUG: A CASE REPORT

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Objectives Necrotizing ulcerative gingivitis (NUG) is a microbial disease of the gingiva in the context of an impaired host response. This form of gingivitis is relatively rare. NUG is an infection characterized by gingival necrosis presenting as "punched-out" papillae, spontaneous bleeding, pain, oral malodor and pseudomembrane formation. Primary predisposing factor is bacterial plaque and inadequate diet, smoking, psychologically stress may also effect disease. NUG is associated with a characteristic bacterial flora, includes fusiform bacteria, spirochetes and Prevotella intermedia. Conventional treatment includes control of both the bacterial plaque and the secondary factors and topical or systemic antimicrobial therapy.

Methods A 34-year-old, systemically healthy, smoker, male patient was referred to our department with severe pain. After clinical and radiographic examination there was clinical attachment loss and poor oral hygiene. A clinical diagnosis of NUG was made. We use LLLT as an adjunct to conventional NUG treatment. Laser was set 0.4W cw and energy density was 9 J/cm<sup>2</sup>.

Results After treatment; patient's quality of life was affected in a positive direction faster compared with conventional treatment. These results suggest that LLLT is an effective treatment for reduction pain level and healing times. Patient is still under follow up.

Conclusions LLLT leads to vasodilation and increases local blood flow, whereby cause more oxygen transport in the region and more immune cells migration into the tissue. This treatment produce a biostimulative effect on wound healing, pain control, and inflammatory processes. Accelerated tissue healing occurs through this effect mechanisms. LLLT can promote the pain relief and healing of NUG. As a result, Our case report show that LLLT has an positive effect to relieve the symptoms of NUG.

#### 0142

Regular consumption of a nitrate-rich lettuce juice beverage decreases gingival inflammation in periodontal recall patients

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Objectives Dietary nitrate has been identified as an important modulator of vascular inflammation.

This two arm prospective, double-blind, placebo-controlled, randomized trial evaluated the influence of the regular consumption of a nitrate-rich lettuce juice beverage on gingival inflammation and plaque control in periodontal recall patients with Gingiva Index (GI) as the primary and Plaque Control Record (PCR) as a secondary endpoint

Methods A total of 44 periodontal recall patients suffering from mild to moderate gingivitis ( $GI > 0 \leq 2$  at a minimum of 3 teeth) were enrolled in the study. Immediately after full mouth supra- and subgingival scaling and without additional oral hygiene instructions the study participants were asked to consume 3 x daily 100 ml of a nitrate-rich lettuce juice beverage (test) or 3 x daily 100 ml of an identical, but nitrate depleted lettuce juice beverage (control) over a period of 14 days in combination with an otherwise nitrate restricted diet. The uptake of dietary nitrate in the test group was calculated to approximate 200 mg nitrate /day, slightly below the Acceptable Daily Intake (ADI) for nitrate of 3.7 mg/kg b.w./day equivalent to 222 mg nitrate per day for a 60 kg adult set by the Joint FAO/WHO Expert Committee on Food Additives (JECFA).

Results While at baseline recorded GI mean scores did not differ significantly between the groups (GI test group:  $0.57 \pm 0.25$ ; GI placebo group:  $0.57 \pm 0.35$ ), at day 14 the observed mean GI score of the test group (GI:  $0.26 \pm$

0,15) was significantly ( $p<0.002$ ) lower than in the placebo group ( $GI: 0,47\pm0,23$ ). Mean PCR scores recorded at baseline and at day 14 did not differ significantly between the groups (baseline test group:  $33,0\% \pm 13,4$ ; baseline placebo group:  $39,0\% \pm 20,2$ ; day 14 test group:  $30,7\% \pm 14,9$ ; day 14 placebo group  $40,5\% \pm 19,7$ ).  
 Conclusions The level of dietary nitrate consumption in the wake of supportive periodontal therapy may be an important modulator of gingival healing.

**0143**

**The effect of Nd:YAG laser therapy on subgingival human herpesviruses in the treatment of chronic periodontitis**

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**Objectives** The aim of the study was to evaluate the subgingival prevalence of human herpesviruses such as human cytomegalovirus (HCMV), Epstein-Barr virus (EBV) and herpes simplex virus (HSV) in chronic periodontitis patients before and after Nd:YAG laser treatment.

**Methods** Sixty-two patients with untreated chronic periodontitis were randomly assigned in parallel groups to receive SRP alone (control group) or Nd:YAG laser (1064nm, 1.5W, 15Hz, 100mj) followed by SRP (test group). Real-time polymerase chain reaction methods were used to determine the presence of HCMV, EBV, and HSV in crevicular fluid specimens collected at baseline and 3 months after treatment by paper points. Clinical periodontal parameters, including plaque index (PI), bleeding on probing (BOP), probing pocket depth (PPD), probing attachment level (PAL) were assessed at baseline and after 3 months.

**Results** The prevalence of HCMV, EBV, and HSV in patients was 34%, 13%, and 9%, respectively. After treatment, the prevalence of HCMV, EBV, and HSV was the lowest in the test group ( $p<0.05$ ). In the test group, the prevalence of HCMV, EBV, and HSV at following treatment was significantly lower than baseline ( $p<0.05$ ). Both treatments yielded significant improvements in terms of decrease in PPD and gain in PAL compared to baseline values ( $p<0.05$ ).

**Conclusions** These results showed that Nd:YAG laser therapy provides a much greater reduction the prevalence of HCMV, EBV, and HSV than SRP in periodontitis patients. This study demonstrated that human herpesviruses may occur in periodontitis lesions with relatively high prevalence.

**0144**

**Effects of nonsurgical periodontal therapy with/without diode laser on periodontopathogens in diabetics with chronic periodontitis**

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**Objectives** The aim of this study was to analyze the effect of diode laser as an adjunct to nonsurgical periodontal treatment on the periodontopathogens in type 2 diabetes mellitus (DM2) with chronic periodontitis patients.

**Methods** Sixty patients with DM2 (HbA1c; 5,7-8,5 %) and chronic periodontitis (CP) were randomly assigned in two groups to receive scaling root planning (SRP, n=30) or SRP followed by diode laser decontamination (SRP+DL, n=30). Clinical periodontal parameters and plaque sampling were assessed at baseline, 1. and 3. months after nonsurgical periodontal treatment. Red complex microorganisms including *Porphyromonas gingivalis* (Pg), *Treponema denticola* (Td), *Tannerella forsythensis* (Tf) were evaluated with quantitative RT-PCR.

**Results** Significant improvements were observed both for clinical parameters (PD and CAL) and for metabolic control of DM2 patients in both treatment groups; overall, the SRP+DL group did significantly better. Significant reductions from baseline were observed at 1. and 3. months for both treatments for numbers of Pg, Td and Tf ( $P<0.001$ ), however no significant differences were noted between the SRP and SRP+DL groups regarding bacterial reductions at these follow-up time points.

**Conclusions** Non-surgical periodontal treatment with diode laser improved better clinical parameters and metabolic control of DM2 patients with CP, however no additional benefit of diode laser as an adjunct to nonsurgical periodontal therapy was recognized in the reduction of Pg, Td and Tf amounts. (This study was supported by The Scientific and Technological Research Council of Turkey TUBITAK/SBAG-114S229 and Research Project Coordination of Selcuk University BAP-11202014)

**0145**

**Effectiveness of systematic periodontal treatment in HIV-infected patients with chronic periodontitis after 11 years**



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**Objectives** Highly active antiretroviral therapy (HAART) significantly changed the incidence and prevalence of periodontal diseases in HIV-infected patients focusing chronic periodontitis today; but only little evidence is available about its long-term treatment outcomes.

It was therefore the purpose of study to investigate clinical treatment outcomes of systematic periodontal treatment including supportive periodontal care after for 11 years in HIV-infected patients with chronic periodontitis as compared to non HIV-infected patients.

**Methods** This was a longitudinal prospective, open-label, parallel-group cohort study conducted in Germany in 24 subjects. Systematic periodontal treatment was defined as non-surgical active periodontal treatment by scaling and root planing and subsequent supportive periodontal care at regularly intervals.

To measure the effectiveness, reductions of periodontal pocket probing depths were chosen as the primary study end point. Secondary study end points were the plaque index, the gingival index, and the semiquantitative subgingival biofilm composition of 20 periodontal pathogens. Tooth loss was defined as safety end point. Statistical analysis comprised signed tests (intra-group comparison), Wilcoxon tests (inter-group comparison), and McNemar tests (binary data) at 0.05 significance level.

**Results** Periodontal pocket probing depths reductions in HIV-infected subjects (-0.4 mm) demonstrated no statistically significant differences as compared to non HIV-infected patients (-0.3 mm) ( $p = 0.5$ ). The extent of the oral biofilm and the extent of gingivitis in the test group was significantly lower as compared to controls ( $p < 0.002$ ). The subgingival biofilm composition demonstrated differences between the groups in terms of amplitude and some periodontal species (*B. forsythia*, *S. gordinii*). No tooth loss was documented in the test group, whereas mean 0.2 teeth were lost in controls ( $p = 0.7$ ).

**Conclusions** Within the limits of this study, it is concluded that systematic periodontal treatment including supportive periodontal care is an effective treatment concept in virologically controlled HIV infection.

#### 0146

Evaluation of Principal Reasons of Tooth Extractions in Turkish Population: A Retrospective Study

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**Objectives** Aim of this study is to investigate causes of tooth extractions, its association with age and gender amongst patients in Afyonkarahisar

**Methods** A record of all tooth extractions complied with the treatment plan performed in Afyon Kocatepe University Faculty of Dentistry Department of Oral and Maxillofacial Surgery for two years period. The analyses of extractions were performed on panoramic x-ray films before and after dental therapy, checked from patient charts retrospectively. The patients' age, gender, number of extracted teeth, and extraction reason(s) were recorded.

**Results** A total of 5759 extracted teeth in 2,658 systemic healthy patients were included. Caries were the main reasons (48.6%) of tooth extractions, followed by periodontal disease, failures in endodontic treatment, patient request, trauma, orthodontic and other reasons (32.3-6.5-5.9-3.3-3.1-0.3%) respectively

**Conclusions** Dental caries are the principal cause for extractions in overall population, while periodontal disease accounts for the majority of tooth loss in patients older than 50 years. This study indicates that excessive carious lesions and difficultness of the restorations are no longer reasons for the decision of extraction.

#### 0147

**Effects of mandibular advancement device (MAD) on upper airway in patients with obstructive sleep apnea syndrome (OSAS) assesment with cone-beam computed tomography (CBCT)**

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**Objectives**

The purpose of the present study was to evaluate the effect of the mandibular advancement device (MAD) on upper airway in patients with obstructive sleep apnea syndrome by measuring the airway volume by using CBCT.

**Methods** Eight patients (five men and three women) with OSAS, mean age  $52.87 \pm 11.22$  years worn an intraoral appliance for mandibular advancement during sleep. For each patient two CBCT scans (i-CAT; Imaging Sciences International, Hatfield, PA) were obtained one with and one without MAD. The measurements of the images were repeated by the same observer for a second time after 2 weeks. Intraclass correlation coefficient (ICC) was utilized to assess the correlation between repeated measurements in the same patient. The mean value of all measurements

were calculated and After Kolmogorov-Smirnov test, paired sample *t* tests was performed for statistical analysis with 0.05 significance level.

Results Mean value of airway volumes with MAD was  $21.19 \pm 9.93$  cc, ranged from 7.25 to 36.97 cc. Mean value of airway volumes without MAD was  $13.99 \pm 5.72$  cc, ranged from 6.10 to 23.10 cc.

The airway volumes were increased in the patients with MAD. A statically significant difference was found between the mean values with/without usage of MAD ( $p < 0.05$ ). And also the ICC showed excellent intraexaminer repeatability (ICC:0.997;95%).

Conclusions In the limitations of this preliminary study , the usage of MAD may be associated with expanding of the upper airway volume of the patients with OSAS. But this mecanism is still under debate and further studies are needed to evaluate the effect of the MAD on the upper airway volume.

**0148**

### **The evaluation of the psychological state and the sleep quality on people who have bruxism**

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Objectives Students of the Faculty of Dentistry in Yeditepe University to investigate the relation between the sleep quality and the psychological state of people who are diagnosed to have bruxism.

Methods A total of 218 individuals including students completing their 2nd, 3rd, 4th, or 5th year of education have been participated in our studies. Before performing the clinical examination, a questionnaire regarding the diagnosis of bruxism has been forwarded to the individuals. With the clinical examination, intraoral symptoms of bruxism have been detected. At the same time, the type of bruxism, such as active and passive, has been identified. Pittsburgh Sleep Quality Index (PSQI) has been used in order to assess the sleep quality. To evaluate the psychological state, however, Symptom Checklist-90-R (SCL-90-R) has been used.

Results Bruxism has been detected on 163 people out of 218 which equals to 74.8% of the total population. The percentage of students with bruxism having poor sleep quality is equal to 68.7, while this percentage decreases to 30.9 on students without bruxism. On 29 (17.8%) students out of 163 with bruxism, high level of psychological symptoms has been detected. For the rest 134 (82.2%) students, it has been noted that the psychological symptoms are in lower levels. Among 161 (98.8%) students out of 163, at least one psychological symptom has been detected. The statistics have shown that depression and anxiety symptoms on students with bruxism are significantly higher than on students without bruxism. When the distribution of psychological symptom test sub units on classes is examined, it has been noted that phobic reactions and hostility symptoms are statistically higher on 3rd year students suffering from bruxism. Somatization symptoms are detected to be high also on the 3rd and 5th year students.

Conclusions In our studies, we have detected poor sleep quality on individuals having bruxism. We have identified the general psychological symptom level as low. When the psychopathology and the sleep quality of individuals with bruxism are compared with eachother, a negative correlation has been detected in between. There are no other existing studies in literature analyzing the correlation between bruxism, sleep quality and psychological state, which expresses further studies are needed.

**0149**

### **Relationship Between Self-assessed Quality Of Mastication, Occlusion Dynamics And Masticatory Function**

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Objectives To determine to what extent is self-assessment of masticatory function related to the objective quality of mastication and clinical assessment of mandibular dynamics.

Methods A total of 26 examinees were included in the pilot research, of which 15 women aged 17-34 years (median 24). Patients fulfilled self-assessment Chewing function questionnaire (CFQ), while clinical evaluation and function analysis included The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) protocol. Patients chewed on a bolus made of silicone (Optosil®)( $r=5$ mm) during 20 seconds. Bolus was analyzed with photo scanner (Image 1.49p, Wayne Rasband, National Institute of Health, USA). For the purpose of assessment of mastication efficiency mean range of Feret diameter of masticated particles was used (distance of the tangent drawn to the opposite side of the particles) together with their total area.

Results Increased self-assessed disruption of masticatory function (CFQ) was found more frequently in women ( $r=0.618$ ) and correlated with poor oral health ( $r=0.510$ ;  $p < 0.05$ ). In addition, the increased pain intensity, reduced unassisted and assisted mouth opening ( $r=-0.443$ - $(-0.635)$ ), and increased frequency of disrupted everyday activity ( $r=0.899$ ;  $p < 0.05$ ) were more pronounced in patients with lower self-assessment of masticatory function. Greater

surface and Feret diameter suggested poorer quality of mastication of silicone bolus, which was connected with an increased self-assessment disruption of masticatory function ( $r=0.460-0.541$ ;  $p<0.05$ ).

Conclusions Self-assessed masticatory function may be positively correlated with objective situation. Patients with temporomandibular symptomatology have lower masticatory function efficiency.

**0150**

### **Shear bond strength of intraoral laser welding and its effect on intrapulpal temperature rise in primary teeth *in vitro***

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**Objectives** The aim of this study was to compare the shear bond strength between conventional welding (CW) and intraoral laser welding (LW) on fixed space maintainers (SMs). Secondly the present in vitro study investigated pulpal temperature rise during LW.

**Methods** Procedure of shear bond strength: 26 molar bands were divided into two groups as CW and LW. 26 pieces of 5 cm length of 0.9 mm diameter stainless steel wires were welded to the middle of the buccal and lingual aspects of bands in each groups. In LW group, the Nd:YAG laser was used for welding. In CW group, Dentaureum silver solder and flux were used as soldering media which were uniformly 4mm in length. The samples were fixed to acrylic resin blocks and were submitted to shear testing. Procedure of intrapulpal temperature: Twenty five exfoliated primary second molar teeth were used to adapt molar bands. J-type thermocouple wire was positioned in the pulp chamber and temperature changes were determined while 26 pieces of 0.9mm diameter stainless steel wires was welded to the bands using Nd : YAG laser. Mann-Whitney U test was used to determine the differences of shear bond strength, between the groups. Temperature changes were analyzed by paired T-test.

**Results** Shear bond strength were found significantly different between groups (LW:  $489.47 \pm 135.70$ , CW:  $49.71 \pm 17.76$ ;  $p<0.001$ ). The mean intrapulpal change during LW was  $3.64 \pm 0.79$  (Min:2.4; Max:5.10). None of the samples intrapulpal temperature change were exceeded the critical threshold value ( $5.5^{\circ}\text{C}$ ).

**Conclusions** The joint obtained by LW has a higher strength compared with CW has demonstrated. Changes of the intrapulpal temperature during LW do not present a thermal risk in the primary teeth. This study demonstrated that intraoral use of LW for space maintainers in primary teeth is successful in terms of strength and intrapulpal temperature changes.

**0153**

### **Effects of low intensity pulsed ultrasound on mesenchymal stem cells**

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Universidad de Chile

**Objectives** Mesenchymal stem cells (MSCs) are biological resources used for tissue engineering and regenerative medicine for the autoimmune and degenerative diseases, and chronic or severe trauma injuries treatments. The use of biomaterials may favor growth conditions, proliferation and differentiation, providing a three-dimensional matrix and biochemical signals. The low-intensity pulsed ultrasound (LIPUS) is a biomechanical signal that induces different responses by a direct effect on the cell membrane, such as osteogenic differentiations.

**Aim:** To determine the *in vitro* effect of LIPUS stimulation on proliferation, differentiation and migration of human periodontal ligament MSCs.

**Methods** Human periodontal ligament MSCs were isolated by root planning from third molar with extraction indication, cultured (D-MEM, 10% FBS and 1% antibiotic) and stimulated with LIPUS, for 20 minutes twice daily for 7 days with  $50\text{mW}/\text{cm}^2$ . They were separated in four groups: adipogenic supplemented culture medium, bioactive glass and bovine collagen matrix, and the fourth group evaluated the cell migration by surface scraping. The absence of LIPUS was used as control. The results were analyzed by Kolgomorov-Smirnov and paired *t-test*.

**Results** On MSCs stimulated with LIPUS, increases in cell number was observed in the presence of bioactive glass and bovine collagen ( $p < 0.05$ ). LIPUS induced osteogenic differentiation in MSCs with adipogenic medium. There was no difference in cell migration.

**Conclusions** Human periodontal ligament MSCs stimulation with LIPUS, increased cell proliferation and osteogenic differentiation.

**0154**

### **Role of mesenchymal stem cells in the immune response in bone destructive diseases.**

**Díaz-Zúñiga, J., Melgar-Rodríguez, S.**

University of Chile

**Objectives** Mesenchymal stem cells (MSCs) are a multipotent, proliferative, immune-competent and fibroblast-like cells, residing in many specialized tissues. MSCs could be differentiated toward osteoblasts, chondroblast, adipocytes, cardiomyocytes, and cementoblasts, among others.

Furthermore, MSCs have a regulatory role in the immune response in auto-immune disorders, and MSCs transplant, diminished neuronal degeneration in ALS patients.

Recently, a potential role in the TCD4<sup>+</sup> lymphocytes differentiation towards T helper (Th) subsets has been described, detecting that MSCs could induce T regulatory or Th17 polarization, depending on the cytokine present in the environment.

Thus, the aim of this review was to determine the potential role of MSCs therapy in bone destructive diseases.

**Methods** A literature review was performed using PubMed and the search pattern [MSC OR SC] AND ["bone destructive disease" OR "bone destruction"]. Inclusion criteria were scientific articles published in ISI indexed journals during the years 2005-2015 and written in english. Fifteen scientific articles were selected and the main results were discussed establishing roles found in immune cells and bone destructive diseases.

**Results** Numerous reports have been demonstrated that MSCs have an anti-inflammatory and immunomodulatory effects by T, B and NK lymphocytes and antigen presenting cells suppression. In fact, MSCs produce transforming growth factor-beta, interleukin 10, prostaglandins and nitric oxide, among other molecules. Nevertheless, in some experimental arthritis models, the administration of MSCs shows opposite effects over collagen and bone destruction. In fact, MSCs promote the expansion of Th17 lymphocytes when acting on previously activated CD4<sup>+</sup>T lymphocytes. These data suggest that MSCs therapy in bone destructive diseases is not recommended.

**Conclusions** MSCs could exert opposing effects on disease activity according to the time of therapeutic application and cell concentration. In bone destructive diseases MSCs could have a bone-destructive role.

## 0155

### **Temporary Prosthetic Approaches For Missing Central Incisor Tooth: Case Series**

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**Objectives** Rehabilitation of missing central incisor is very difficult situation esthetically and functionally. Various reasons like trauma, external resorption, tooth decay can be cause of missing tooth. This challenging condition can be rehabilitate with different options. Fixed partial dentures and implant replacement are common solutions. However, adhesive fixed dental prosthesis or removable dental prosthesis in anterior region can be esthetic, practical and rapid solution.

**Methods** Three cases with esthetic problem because of missing central incisor presented to Kocaeli University Department of Prosthodontics.

#### Case I:

A 31-year-old female had a horizontal fractured in her left upper central incisor because of trauma. Central incisor were examined by radiographically and clinically and tooth extraction, implant replacement and esthetically rehabilitation for healing period of patient with an adhesive fixed dental prosthesis were planned. Patient's tooth was used for directly adhesive fixed dental prosthesis.

#### Case II:

A 16-year-old male were with missing left central incisor due to external resorption of tooth. Implant replacement was planned at the end of bone growth period. For waiting period, adhesive fixed dental prosthesis indirectly was done for rehabilitation of esthetic.

#### Case III:

A 17-year-old male missed his left central incisor because of the trauma. Patient was examined radiographically and clinically. Patient did not want any preparation for teeth even minimally. Therefore, removable dental prosthesis was planned as a retainer until the implant replacement.

**Results** These approaches are conservative and very good solutions for esthetic problems. Also, patient satisfied with the practical of these prosthesis.

**Conclusions** Loss of central incisor is a challenging problem for clinicians. These dental prosthesis have esthetic and practical improvements for cases as a provisional solution.

## 0156

### **Cantilever fixed partial prosthesis with monolithic zirconia ceramic system: A Clinical Case Report**

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**Objectives** Most of the current all-ceramic restorations are composed of monolithic yttria-stabilized tetragonal zirconia polycrystal (Y-TZP) ceramics, which exhibits superior mechanical and aesthetic properties compared with

other ceramics. Monolithic zirconia is a biocompatible material that is not cytotoxic, has low bacterial adhesion and provides full ceramic multi unit restorations.

The purpose of this study was to restore the missing anterior teeth without metal support and meanwhile during the high-tech rehabilitation applications, while eliminating porcelain covering technique it was important to keep the translucent property of monolithic zirconia which was not possible to keep with conventional zirconia supported restorations.

Methods 14 years old male patient was admitted concerning missing tooth of right maxillary lateral. Cantilever restoration is decided to apply considering both the young age of patient and possible physiological problems due to the outer view since not to affect growing pattern of maxilla or not to cause problems due to 3 unit conventional prosthesis. After right upper canine tooth preparation and impression, monolithic zirconia ceramic system is used. Results Good esthetic and functional results were achieved with no complications reported after 12 months.

Conclusions Prosthetic rehabilitation using monolithic zirconia may help to prevent complications associated with bi-layered ceramics systems. Further studies are essential to provide long-term data about the clinical performance of this type of prostheses.

**0157**

### **REHABILITATION OF VERTICAL DIMENSION OF OCCLUSION : A CASE REPORT**

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Erciyes University Faculty of Dentistry

Objectives Bruxism caused from diet or stress leads to temporomandibular joint disorders and tooth wear. As a result of wear, weak masticatory function, dentin hypersensitivity, death of the teeth and at least aesthetic problems exist. Consequently it leads to lose of vertical dimension. By the way the restorative treatment of damaging tooth is necessary to prevent the destructive effects. It s needed to be adjustment vertical dimension of occlusion.

Methods A 50 year old male patient presented at Erciyes University School of Dentistry. His complaint was pain at palatal mucosa while chewing and poor aesthetic appearance.

In clinical examination lower incisors was in contact with palatal mucosa and vertical dimension of occlusion decreased. There was progressive loss in tooth substance. Resting occlusal dimension was about 8 mm.

A removable occlusal splint was fabricated and adjusted as centric relation. the purpose of splint was to increase the Occlusal dimension for 6mm long safely.

It is recommended to use of the occlusal splint regularly for 8 weeks. Patient is called after 1 week and 4 weeks for control sessions.

After use of the splint patient had no pain of muscles or temporomandibular joint. He is adapted new occlusal relation and had no discomfort.

Results Total of 27 teeth were prepared and 30 of metal-ceramic restorations were planned in acquired vertical dimension.

Restorations were fabricated and after occlusal adjustment cemented with polycarboxylate cement.

Conclusions it is advantageous to consider increasing the VDO since it will provide space for restorative material, improve the esthetic tooth display, correct anterior teeth relationship, and minimize the invasive clinical procedure such as crown-lengthening surgery and elective endodontic treatment.

**0158**

### **Zygoma Implant-Supported Prosthetic Rehabilitation of a Patient After Bilateral Maxillectomy**

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Objectives This article describes the prosthetic rehabilitation of a patient with a severe intraoral defect resulting from a maxillectomy resection, using two zygoma implants connected by CAD/CAM-fabricated milled bar (infrastructure framework) and a maxillary obturator prosthesis.

Methods A 52-year-old male Prosthodontic Diagnostic Index (PDI) Class IV patient that had a history of a bilateral maxillectomy for resection of a squamous oral cell carcinoma of the hard palate was referred to our department for oral rehabilitation by Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul University.

Intraoral examination revealed two zygoma implants (Zygoma Fixture, NobelBiocare) that 1 on the right side and 1 contralaterally. Multiunit abutments were connected to the implant body and a transfer impression (Impregum Penta, 3M ESPE) over the implants was made. A free shape milled bar were designed without following a particular manufacturing shape and customized according to the denture tooth arrangement and the soft tissues. Before the manufacturing of infrastructure framework, acrylate polymer blocks (Tizian Blank PMMA, Schütz Dental GmbH)

were initially used for the fabrication of replica bar using CAD/CAM to control intraoral compatibility. Maxillary obturator prosthesis and mandibular complete denture was completed and placed in the oral cavity in 2014. Turkish version of the 14-item questionnaire<sup>1</sup> was given to patient before (temporary obturator prosthesis) and after oral rehabilitation for self-completion to evaluate functional, esthetic, and psychologic satisfaction (Table 1). Each item was scored by a number, with the final score (range: 0-29).

**Results** Following delivery of the prosthesis, the patient's response was favorable in relation to esthetics, speech, swallowing and mastication while the patient's oral and facial appearance improved. A significant decrease in the total questionnaire score between the temporary obturator prosthesis (score = 18) and the zygoma implant-supported definitive obturator prosthesis (score = 2), suggesting an improvement in the patients quality of life and self-esteem.

**Conclusions** Zygoma implant-supported obturator prosthesis have excellent retention and stability, and there is no displacement of the denture during speech and mastication.

A 14-item questionnaire was given to the patient to evaluate functional, esthetic, and psychologic satisfaction

Q1	During the day, how many hours do you wear your obturator prosthesis? (0)Nearly 24 h (1)Nearly 12 h (2)Less than 8 h (3)Nearly not worn
Q2	Do you wear your obturator prosthesis for social occasions? (0)Yes (1)No
Q3	Do you wear your obturator prosthesis for eating? (0)Yes (1)No
Q4	How well are you able to chew your daily soft food? (0)No difficulty (1)Little difficulty (2)Great difficulty
Q5	Can you eat hard food? (0)Yes (1)No
Q6	Can you eat on the defect side comfortably? (0)Yes (1)No
Q7	How well are you able to swallow daily food? (0)No difficulty (1)Little difficulty (2)Great difficulty
Q8	How well is the oro-nasal separation during drinking and eating? (0)Very good (1)Fairly good (2)Fairly bad (3)Very bad
Q9	Can you speak comfortably with your obturator prosthesis without dislodgement? (0)Yes, for long period of time (1)Yes, for short period of time (2)No, I can
Q10	In your opinion, how stable is your obturator during speech? (0)Very good (1)Fairly good (2)Fairly bad (3)Very bad
Q11	How satisfied are you with your obturator prosthesis esthetics? (0)Very satisfied (1)Fairly satisfied (2)Fairly unsatisfied (3)Very unsatisfied
Q12	Do you perform oral hygiene care? (0)Regularly (1)Not often (2)Not at all
Q13	How much is the effect of your obturator prosthesis on your daily life? (0)Great effect (1)Moderate effect (2)Minor effect (3)No effect
Q14	By the help of your obturator prosthesis, do you feel that you are? (0)Normal person (1)Near normal (2)Abnormal

0159

**An alternative prosthetic rehabilitation following self-inflicted gun shot wound to mandible**

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**Objectives** Gunshot injuries to the head can have serious esthetic and functional consequences. This report describes the prosthodontic rehabilitation of a patient traumatized by a self-inflicted gun-shot wound to the mandible which required rehabilitation with a free fibula graft.

**Methods** A 43-year-old man presented with a self-inflicted gunshot wound reconstructed with fibula graft was referred to Selcuk University Faculty of Dentistry, Department of Prosthodontics. On examination, he exhibited extraoral scarring from the fibular reconstruction in the left submandibular and neck area. Intraoral evaluation of the dentition exhibited a large grafted area started from left mandibular molar region to right canine region. Various prosthetic designs and the choice of available prosthetic materials are discussed with the patient.

Remaining teeth in the left and right side of the mandible were prepared and a metal bar was used to cross the mobile soft tissue bed of the graft site. An acrylic partial removable dental prosthesis was placed over the bar. Two ball attachments were placed over the bar to increase the retention of removable prosthesis.

**Results** A removable denture was produced over a fixed metal bar to tolerate soft tissue loss for the restoration of gun-shot wound site.

**Conclusions** Removable partial dentures can be used to reduce the cost of the treatment instead of implant therapy in the prosthetic rehabilitation of patients with graft taken from tibia or fibula when adequate teeth support was provided around the graft site.

**0160**

### **Functional and Esthetic Treatment Of A Cleft Lip And Palate Adult Patient With Fixed Prosthodontic Rehabilitation**

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**Objectives** The prosthetic treatment of cleft lip and palate patients could differ based on the size of the defect, the condition of the remaining teeth, and socio-economic status and age of the patient. The aim of this case report is rehabilitation of cleft lip and palate patient with old removable dentures.

**Methods** 29 years old male patient applied our prosthetics clinic with complain from old removable dentures due to movement of prosthesis during function. In the intra oral exam of the patient 11,12,13, 21,22,23 teeth were missing and there were overdenture prosthesis and coping on the 24, 25, 14, 15 teeth. After intraoral and radiographic examination was decided fixed partial dentures since 14-24 distance very short. Afterwards 14,15,16, 24,25,26 teeth was prepared for fixed partial denture and then prosthesis was made.

**Results** After prosthetic rehabilitation there was no movement of prosthesis and aesthetic expectations of the patient were provided in the best way and patient was very satisfied.

**Conclusions** If intraoral situation of cleft lip and palate patients are suitable, fixed partial denture can be made. Because this prosthesis is very comfortable and aesthetic than removable dentures.

**0161**

### **A Case Report In A Patient With Ectodermal Dysplasia-Olivopontocerebellar Degeneration**

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A healthy 20 year-old male patient applied our clinic with lack of teeth and appearance complaints, then diagnosed with ectodermal dysplasia-olivopontocerebellar degeneration. Ectodermal dysplasia is a general term for hereditary disorders which are characterised by abnormal skin, hair, nail or teeth. Olivopontocerebellar degeneration is one of the hereditary spinocerebellar degeneration syndromes with ataxia and tremor, as well as various motor and sensory deficits. In this patient extra-oral examination revealed hypodontia, wide space teeth, small teeth, peg shape teeth, small triangular face, thin lower lip. These abnormalities caused functional, esthetic and psychological problems. This case report describes treatment of this patient. Radiographic evaluation was carried out to know the status of teeth and bone. Panoramic radiograph revealed that roots of teeth were surrounded by healthy bone. The number and distribution of the teeth were optimum for fixed prosthesis. So this patient was treated with fixed prosthesis by increasing vertical dimension of the face. Psychological benefits associated with fixed prostheses (tooth-supported) have significant positive effects on growth, social development, self-image and food choice. Quality of life also improves in oligodontia patients with prosthodontic treatment.

**Prosthodontic rehabilitation in Papillon-Lefevre syndrome: A case report**DOLGUN, F. Z.<sup>1</sup>, SARI, F.<sup>1</sup>, Simsek, M.<sup>2</sup><sup>1</sup>Faculty of Dentistry, Gaziantep University, Turkey, <sup>2</sup>Gaziantep University

**Objectives :** Papillon Lefevre Syndrome (PLS) is an autosomal recessive (AR) disorder affecting the skin and intra oral soft tissues resulting in palmo plantar hyperkeratosis with premature periodontal problems leading to early tooth loss and associated functional and psychological disturbances. Functional, esthetics, developmental and psychological problems may arise in the PapillonLefevre Syndrome during childhood. The disorder occurs in approximately 1 to 4 individuals per 1.000.000. The exact etiology is still unknown. Patients are often edentulous at an early age.

**Methods** A 14-year-old female patient presented to the department of Prosthodontic, Faculty of Dentistry, Gaziantep University, Gaziantep, Turkey, with the chief complaint of multiple loss of teeth. Most of her natural dentition was missing. The remaining four natural teeth had periodontal lesions. She was presented with the chief complaint of loss of many permanent teeth and mobility of the remaining teeth. Most of the teeth were lost very early after their eruption due to swollen infected gums. There were no other associated problems except for the mild burning sensation of the palms and soles. A decision was made and remaining teeth were extracted in order to prevent aggressive bone loss. She was then managed using removable partial dentures with bilateral balanced occlusion with little retentive help from the most posterior molars.

**Results** The patient is comfortable and functioning well with her new dentition. Prosthodontic rehabilitation provides a psychological boost up to the patient as well as to the parents by restoring not only the esthetic appearance but also the function. The PLS debilitates individuals socially, psychologically, and physically.

**Conclusions** Thus, prosthetic replacement in such patients is an age specific, speciality treatment involving initial replacement with complete or partial dentures and future consideration for an implant-supported prosthesis



**0163**

**Multidisciplinary Approach to Anterior Aesthetic and Smile Design**

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**Objectives** Treatment of patients dental esthetic problems is one of the most important topics in contemporary dentistry. Not only the appearance of the teeth but also soft tissue health and contours are significantly affective in smile design.

**Methods** 37 years old female patient with esthetic complaints due to old prosthetic restorations attended to prosthodontics clinic of Kocatepe University Faculty of Dentistry. After clinical and radiographic examinations, the problems were; gummy smile, short clinical crown height and cervical gaps between restorations and gingiva. Due to inadequate interocclusal space and short clinic crown heights, it was decided to lenghten crown height with gingivectomy at the periodontology department. The prosthetic restoration consists maxiller and mandibular visually observerable teeth including the premolars. Although the aim was all esthetic restoration, due to financial difficulties metal infrastructure had to be used.

**Results** At the end of treatment, more satisfactory esthetic appearance was achieved.

**Conclusions** The teeth and the soft tissues should be considered as a whole at anterior esthetics and smile design.

**0164**

**Esthetics anterior crowns with monoblock zirconia ceramic system: A Clinical Case Report**

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Faculty of Dentistry, Prosthodontics

**Objectives** Monoblock yttria-stabilized tetragonal zirconia polycrystal (Y-TZP) ceramics, became one of the most current material which exhibits high mechanical and aesthetic properties compared with other ceramics. Monoblock zirconia is a biocompatible non toxic material with low bacterial adhesion and which eliminates multilayering of ceramics.

The purpose of this report was to restore unaesthetics appearance of maxillary anterior teeth with full ceramic restoration.

**Methods** A 27 year-old male patient with hypomineralized enamel, deep bite and wear on occlusal surfaces which indicates the patient has bruxism. Full ceramic restorations were planned for maximum light translucency and natural appearance but deep bite and the bruksism avoided the use of lithium disilicate ceramics. Conventional zirconia systems could not be used due to limited occlusal space. Monolithic zirconia was chosen for its' translucency for anterior esthetics and strength.

**Results** No esthetic and functional complications were reported after 12 months.

**Conclusions** Prosthetic rehabilitation using monolithic zirconia may help to prevent complications associated with bilayered ceramics systems.

**0165**

**Natural Tooth Pontic Bridge with Fiber Reinforcement Ribbon: 3 Case Reports**

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**Objectives** Conservative treatment for an esthetic problem provided in a single visit and a chair side procedure to improve a smile.

**Methods** Three patients whose anterior tooth was planned to be extracted were referred to our department for a conservative, rapid, and economic treatment. After radiographic and clinical examinations, it was decided that the tooth which was to be extracted should be used for the restoration of its own extracted area. The extracted tooth was splinted using Ribbond fiber (Ribbond Inc., Seattle WA) to adjacent teeth with the aid of the surface modifications on extracted tooth and adjacent teeth. After three months later, patients were recalled and bridges were evaluated. **Results** The bridges were functioning well after 3 months. The conservative bridges with natural tooth pontic satisfied the patients with good mechanical behavior, and long-term durability.

**Conclusions** In conclusion, these reports describe a simple, economical, rapid and conservative chairside technique for restoring a single anterior tooth using the patient's own extracted tooth and ribbond fiber. This chair side technique does not require laboratory procedures. Patient gets immediate benefit by repositioning the extracted tooth. The conservative bridges with natural tooth pontic can make patient happier and more confident.

**0166**

**“The Incredible Bulk”, or are multi-layers still required?**

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Bulk-fill resin-based composite technology is not a new phenomenon but has seen a recent resurgence and rapid increase in popularity by dental practitioners over the last 5 years. Success of these material types is driven by dentists' demand for decreasing surgery time and improved convenience over an incremental layered approach. The key material properties include increased depth of cure, ideally to at least 4mm, reduced shrinkage or elastic modulus in attempt to decrease associated polymerisation stress and either the use of flowable or higher viscosity formulations. The premise of increasing depth of cure is relatively simple: improve light transport by reducing pigment absorption or filler scattering, either by increasing translucency using less colour or reducing filler content, which will compromise both aesthetic quality and mechanical properties, respectively. Reduced shrinkage formulations, or more importantly, those that result in minimal shrinkage stress is also a key design challenge given the substantially higher curing volume compared with that of conventional incremental placement protocols. This presentation will discuss how light transmission can be increased through a bulk-curing material and explores some of the novel chemistries that have been developed in order to overcome significant challenges of polymerization stress and aims to briefly review the literature on laboratory-based and short-term clinical evidence of bulk-fill materials to date in order to understand whether bulk materials are set to be the future of dental restorative technology.

0167

**Bulk-Fill Materials - Shrinkage, Stress and Wear.**

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"Bulk fill" materials are the latest trend in the development of composite materials. While the term "bulk fill" is clearly misleading as the depth of cure of these material is also limited by the laws of physics, the curing depth of these light curing materials could be increased to 4 - 5 mm thick layers. Several strategies are pursued to achieve thicker increments and keep the curing stress at an acceptable level at the same time. The traditional approach follows the concept of increasing the filler load to substitute the amount of monomer. The use of hybrid composite prepolymers reminds to the beginnings of the inhomogeneous filled microfilled materials. The strategy to increase the filler load comes with the price of an increased viscosity which urges the dentist to carefully adapt these materials to the cavity walls during placement. An alternative approach to achieve a higher increment thickness is based on the application of low modulus materials. The lower elastic modulus keeps the contraction stress within reasonable limits. The low modulus materials adapt well to the cavity but require a cover layer of a material better suited to bear the occlusal loads in the posterior dentition. Both strategies are complemented by a plethora of variations like new monomers, new initiator systems or improved curing lights. We investigated most commercially available "bulk fill" materials and measured their free-shrinkage (improved Watts-Cash-Method, Watts & Cash 1991), contraction stress (Stress-Strain-Analyzer, Dullin 1998), their ACTA wear properties and marginal adaptation. From the multitude of data the following conclusion can be drawn:- The commercial materials of different manufacturers do not exhibit any kind of association between shrinkage and stress.- The stress of 2 mm increments usually is higher than the stress of 4 mm increments. This means that the 4 mm increments do not cure as well as 2 mm increments through the whole volume.- The flowable materials have a higher ACTA wear than the highly filled representatives of this material group, which is in accordance with the manufacturers own assessment that it is necessary to cover the flowable "bulk fill" materials with a load bearing layer of another posterior composite.- The marginal adaptation reveals acceptable marginal gap percentages as long as small to medium size cavities are restored. In wide restorations the proportion of bacteria tight margins is significantly less than in average size cavities.- In our experiments a polywave curing light was not different when compared to a LED curing light with only one emission maximum. Conclusion: The most important contribution of the "bulk fill" materials to modern dentistry is the fact that due to this new trend an enormous amount of energy is spent to further optimize the composition of dental composite materials. Not all strategies are new. Not all strategies are successful. Thus the topic "bulk fill" materials will promote the further development of all composites in the long run.

0168

**Bulk Fill materials – Just a trend?**

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Objectives: The shrinkage and contraction stress (30 min) of six commercial bulk fill composites were measured and compared to different commercially available composites. Furthermore, long-term contraction stress (3 months) was measured to determine the effect of hygroscopic expansion. Methods: Short-term (30 min) volumetric shrinkage (n=5) and contraction stress (n=5) of the different composites (Filtek BF, Tetric-EvoCeram BF, X-tra Base Flow, Venus U BF Flow, SDR, and ELS BF Flow) were measured by mercury dilatometry and a universal testing machine. The long-term contraction stress (3 months) was measured by the deflection of a bi-layer strip of metal and the resin-based composite, that were stored dry (n=4) as well as wet (n=8) to determine the effect of hygroscopic expansion. The following 6 resin composites were investigated (QuiXfil, Smart Dentin Replacement, X-tra Fil, Filtek Supreme XTE, ELS, ELS Flow). One-way ANOVA and Tukey's post hoc test were used to analyze the deflection of the laminate strips, volumetric shrinkage and contraction stress. Results: Short-term volumetric shrinkage and contraction stress showed that Filtek BF, Tetric-EvoCeram BF, X-tra Base Flow behaved like universal composites, Venus U BF Flow like a flowable composite, and the lowest shrinkage and contraction stress values were obtained for SDR, and ELS BF Flow. Water storage showed that the deflection is reduced to zero and remains stable for nearly all composites up to 3 months. The volumetric shrinkage ( $r^2=0.18$ ) and the initial contraction stress ( $r^2=0.74$ ) were correlated to the initial deflection. The absolute water sorption did not correlate to shrinkage ( $r^2=0.02$ ), contraction stress ( $r^2=0.25$ ), and deflection ( $r^2=0.50$ ), but the relative water sorption, compensated for the matrix volume, correlated well to the contraction stress ( $r^2=0.72$ ), and deflection ( $r^2=0.90$ ). Conclusions: The shrinkage and contraction stress of commercial bulk fill composites were measured and showed significant differences between them. The lowest shrinkage and contraction stress values were obtained for SDR, and ELS BF Flow. The initial contraction stress correlated with the deflection. The internal stress in the matrix is directly related to the water sorption during relaxation. In order to create mechanically stable resin composites, the development of resin matrices should focus on materials with low internal stress.

0169

**Resilience: a new oral health concept beyond the absence of disease.**

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Oral health is generally being described as a state of being free from (chronic) oral diseases, including periodontal disease, and tooth decay. This approach is reflected in many of the current strategies to maintain oral health, which are based on the inactivation and eradication of pathogenic bacteria and processes of pathogenesis. We suggest a different approach where emphasis is given on the natural processes in the oral ecosystem that provide resilience and that are involved in the maintenance of oral health. The oral cavity is a diverse and complex ecosystem driven by bacterial interactions, diet, and the host cellular responses. Like other biological ecosystems, the oral cavity possesses mechanisms to counteract environmental challenges and to restore and maintain its biological, homeostatic state. Different processes take place at different levels, ensuring integrity at the level of epithelial cells, the hard tissues but in-concert ensure homeostatic control over the composition and function of the ecosystems as a whole. While it is clear that these processes for homeostatic self-control are at the basis of our ability to maintain oral health, we currently have very little integrated knowledge on these processes, nor have they been embedded within the current methods for prevention of oral disease. During the presentation an overview will be given of the ecological principles for homeostatic control and our current knowledge on the mechanisms for self-control and resilience. Furthermore, recent advances will be discussed that were obtained in a public-private research collaboration in which an integrative multidisciplinary approach has been used, combining biochemical, immunological and microbial data in studying the oral ecosystem under conditions of reversible challenges. The identification of the processes that confer resilience of the oral ecosystem allows us to develop more efficient strategies to promote the maintenance of oral health.

0170

**Role of salivary mucins in the maintenance of microbial ecology of the oral cavity.**

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The mouth is the home of a myriad of different aerobic and anaerobic microorganisms, which together with saliva (the mouth fluid) form a complex and stable ecosystem. Saliva plays a key role in maintaining the steady state of this system, as becomes clear when the bacterial clearance by saliva is blocked, for instance in sedated patients in the intensive care unit. Within two weeks, in the majority of these patients a shift in the oral microflora occurs from Gram-positive to Gram-negative species, which subsequently spread into the respiratory tract causing pulmonary afflictions. This is one illustration of the role of saliva in the maintenance of a healthy oral ecology, but similar observations can be made in other patients suffering from an impaired saliva secretion. This presentation focuses on the role of the mucin component of saliva in the modulation of the oral microflora. Mucins comprise a class of highly glycosylated proteins which endow saliva with its characteristic visco-elastic properties. They are the main constituents of the mucous films that protect the underlying hard and soft tissues against injury. Mucins contain an extraordinary diverse set of oligosaccharides, which as potential receptors for microorganisms control the adherence of microorganisms. On the other hand these oligosaccharides serve as growth substrate for microorganisms under conditions of low external nutrient supply, e.g. between meals and during the night. Degradation of the complex oligosaccharide sidechains, however, requires the concerted action of a large number of different glycosidases, each targeting a specific glycosidic linkage. In this way, the carbohydrate moiety of salivary mucins promotes both the complexity and stability of the oral ecosystem.

0171

**The normal oral microbiome at health**

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The human microbiome has evolved in symbiosis with its host for thousands of years. This has resulted in highly efficient host-bacterial mutualism. For instance, our gut microbes are responsible for a large part of digestion of our food, production of essential nutrients and training and fine-tuning of our immune system. The role of the normal oral microbiome at health and its impact on general health is less well studied. Here we will address the potential roles these microbial communities could play. We will also illustrate the niche-specific composition of oral microbial ecosystem at health using the results from TIFN Oral Health project. Within this project we have obtained microbiome profiles of 268 healthy young adults from different intraoral niches – supra- and subgingival plaque, interproximal plaque, anterior and posterior tongue, as well as saliva. The relation of the niche-specific oral microbiome to the host-related parameters will be discussed.

0172

**The immunobiology of the healthy periodontium**

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The majority of the population lives in relative harmony with the millions of bacteria, yeast and virus in the oral cavity. They do not develop spreading infections or sepsis. Teeth are non-shedding surfaces in the oral cavity and their penetrance through the oral mucosal lining forms a special vulnerable place for local and systemic bacterial infections. The periodontal tissues constitute the “seal” around the teeth and are the place of action of innate immune mechanisms. Despite the existence of a subgingival bacterial dental plaque on the enamel and tooth root surface, the host lives in symbiosis with these biofilms. 80-85% of individuals from any global population have sufficient protective or “normal” immune mechanisms to prevent severe periodontal inflammatory reactions with subsequent periodontal destruction as a result of periodontitis. The normal immunobiology of the periodontium includes a constant interstitial flow of active polymorphonuclear leukocytes (PMN) from the microvasculature migrating to the gingival sulcus by a chemotactic gradient. The pocket epithelial lining is one source for chemokines. Within the epithelial cells dendritic cells “sample” bacterial antigens from the subgingival biofilms and present these to T-cells and B-cells in regional lymph nodes. Non-pro-inflammatory T and B cells are located in the periodontal tissues, and keep mild gingival inflammation in a “resolving” mode, preventing the innate immunity to transform to a pro-inflammatory state. Monocytes/macrophages in the healthy periodontal tissues are considered key cells in directing the local host response and keeping it in the normal mode. In this presentation the normal interplay between PMN, B- and T-cells, monocytes, surveillance-antibodies and complement in the healthy periodontium will be discussed.

0173

**Characterization of translucent monolithic zirconia surfaces subjected to mechanical and hydrothermal aging.**

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**Objectives** To characterize the morphology, roughness and structure of two commercially available translucent zirconia products for monolithic restorations.

**Methods** Rectangular Y-TZP specimens (10x10x3 mm<sup>3</sup>, n=4 per group) were prepared from BruxZir HT (group B) and Zenostar Translucent Pure (group Z) and mechanically polished up to 0.5 µm using wet diamond disks. The specimens were subjected to load and hydrothermal cycling in chewing simulator under the following conditions: Empress MT glazed antagonists, 1,5 M cycles, reduced impulse, 80 N load at 0.9 Hz frequency, 0.4 s single-loading period with 0.7 mm lateral shift, 5°C/55°C thermal-cycling (diH<sub>2</sub>O). The worn and intact areas of the specimens were examined by stereomicroscopy, optical interferometric profilometry (volume loss, max depth plus Sa, Sz, Str, Sds, Sdr, Sci 3D-roughness parameters), Raman microspectroscopy (monoclinic phase content-Vm) and SEM/EDX. **Results** The material loss of the products tested showed no statistically significant difference in volume loss (B:2.55±1.91 µm<sup>3</sup>; Z:2.84±0.5 µm<sup>3</sup>) and max depth (B:13.18±4.38 µm; Z:14.05±1.01 µm). No statistically significant differences were found in the worn regions between B-Z in Sa (88.1-87.1 nm), Sz (447.9-393.6 nm), Str (0.39-0.45), Sds (321.9-377.3 1/mm<sup>2</sup>), Sdr (0.01-0.02), Sci (1.47-1.42). However, the worn regions showed significant differences in Sa, Sz, Sdr (higher) and Str, Sdr (lower) roughness parameters in comparison with their intact controls (p<0.05). No clear monoclinic zirconia peaks were identified in the Raman spectra of reference, thermal-

cycled and load- plus thermal-cycled specimens. After curve-fitting, though, traces of monoclinic phase were identified in all products under all conditions.

Worn surfaces showed areas with a granular appearance, some cracks and presence of phases from the antagonists.

Conclusions No statistically significant differences were found in the properties evaluated between the two translucent zirconia products tested, anticipating thus similar clinical performance.

**0174**

#### **Evaluation of Femtosecond Laser Treatment On Zirconia-Resin Cement Bonding**

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**Objectives** Femtosecond laser treatment of the zirconia surface significantly increases surface roughness without inducing phase change of the zirconia ceramic. Present study evaluated the effects of femtosecond laser and conventional surface treatment methods of zirconia to resin cement shear bond strength (SBS).

**Methods** Eighty four Square-shaped (2x10x10 mm) zirconia specimens were divided into 6 groups (n=14) according to surface treatment as follows: Group SB, air-borne-particle abrasion with 110 µm Al<sub>2</sub>O<sub>3</sub>; group R, tribochemical silica coating; group PS, plasma sputtering; group FL, femtosecond laser application, group FL-SB, femtosecond laser application followed by air-borne-particle abrasion and group SB-FL, air-borne-particle abrasion followed by femtosecond laser application. A cylindrical teflon mold with a 4 mm diameter hole and a height of 3 mm was fabricated. The PVC ring was seated in the center of the hole, and resin cement (Panavia F 2.0, Kuraray Medical Inc., Tokyo, Japan) was applied in the hole and polymerized using an LED curing light. Seventy two specimens were subjected to shear force in a universal testing machine at a crosshead speed of 0.5 mm/min for measurement of shear bond strength. Two specimens were analyzed with a profilometer and SEM for each group (total of 12 specimens).

**Results** The SBS values of FL (13.35±2.48 MPa), SB+FL (13.23±1.84 MPa) and FL+SB (11.31±2.07 MPa) were statistically higher than the other groups (p<0.05). However, there were no statistically significant differences in the SBS values of groups FL, SB+FL and FL+SB (p>0.05). The other groups SB (7.66±2.04 MPa), R (5.62±1.39 MPa), PS (7.39±2.98 MPa) had lower SBS values than laser treated groups (p<0.05) and not significantly different from each other (p>0.05).

**Conclusions** Femtosecond laser treatment of the zirconia surface provided significantly higher bond strength than conventional methods. The present study suggests that combination with aluminum oxide abrasion is not required for laser treatment.

**0175**

#### **A novel etching technique for surface treatment of zirconia ceramics for improved adhesion between resin based materials and zirconia ceramics**

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NIOM - Nordic Institute of Dental Materials

**Objectives** Bonding of zirconia crowns and bridges to abutments is important, not only bonding of the thin resin layer to the abutment, but also bonding to the zirconia ceramic is crucial. Both mechanical as well as chemical adhesion is desired. Mechanical retention of dental porcelain achieved by etching with moderately concentrated hydrofluoric acid is not possible with zirconia ceramics. The purpose of this study was to show that etching is possible with relative low melting fluoride compounds (such as ammonium hydrogen difluoride and potassium hydrogen difluoride).

**Methods** Before melting the fluorides can be introduced as powders or as an aqueous slurry to the contact surfaces of the zirconia. SEM of the etched yttria-stabilized zirconia surface revealed a surface similar to an HF-etched dental feldspathic porcelain surface. Shear bond testing (n=10) was done with zirconia attached to zirconia with the Duo-Link composite luting cement (Bisco) after treatment of the etched zirconia surfaces with Bis-Silane (Bisco) and the Porcelain Bonding Resin (Bisco).

**Results** Values ranging from 20 to 68 MPa for adhesive strengths with surfaces etched with: powders; K[FHF] (31.2±7.5) MPa; NH<sub>4</sub>[FHF] (31.0±11.8) MPa, and slurries: K[FHF] (42.7±12.7) MPa; NH<sub>4</sub>[FHF] (40.3±10.0) MPa (mean and standard deviation). A composite, Charisma A3 (Heraeus Kulzer), attached to zirconia with the same bonding system and surface treatments gave results ranging from 7.5 to 15.2 MPa with the zirconia surfaces etched with: powders; K[FHF] (11.1±2.2) MPa; NH<sub>4</sub>[FHF] (12.9±2.0) MPa, and slurries: K[FHF] (10.0±1.8) MPa; NH<sub>4</sub>[FHF] (11.9±1.7) MPa. The lower adhesion strength values of the composite/zirconia system than with zirconia/zirconia system were probably due to strains induced during polymerization shrinkage accompanied by

internal stresses.

Conclusions Good adhesion to zirconia can be achieved by the procedure including etching with selected melted fluoride compounds.

0176

# **Evaluation of The Resin Cement Polymerization Beneath Monolithic Zirconia**

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**Objectives** The aim of this research was to evaluate the degree of conversion (DC) of two different resin cements when photocured under monolithic zirconia specimens in different thicknesses and colors

**Methods** Partially stabilized monolithic zirconia blocks were cut into three different thicknesses (0.5, 1.0, and 2.0 mm) and the specimens were divided into four color groups (A1, A2, A3, and A4). Dual-cure or light-cure resin cement was applied into a teflon mold and irradiated using the light-emitting diode curing unit for 20 seconds under monolithic zirconia specimens (n=10). Resin cement specimens were stored at room temperature under dry conditions. Each sample's DC was measured by Fourier transform infrared attenuated total reflection (FT-IR/ATR) spectroscopy after the 1<sup>st</sup> and 10<sup>th</sup> days. Data were analyzed with 2-way repeated-measure analysis of variance (ANOVA), 3-way repeated-measure ANOVA, and the Tukey LSD test (p<0.05).

**Results** The light-cured resin cement groups showed a higher DC than the dual-cure resin cement groups (p<0.05). The DC of both resin cements were reduced with increasing the thickness and darkening of the color of monolithic zirconia specimens. There was no statistically meaningful difference between the 1<sup>st</sup>- and 10<sup>th</sup>-day values for light-cure resin cement (p>0.05), whereas there was a statistically meaningful increase in the 10<sup>th</sup>-day values for dual-cure resin cement (p<0.05).

**Conclusions** Within the limitations of this study, light-cure resin cement could be suggested for luting of monolithic zirconia restorations.

Results of 2-way repeated-measure ANOVA

R. Cement	Effect	Type III Sum of Squares	df	Mean Square	F	p
Panavia F 2.0	Color	9301.08	3	3100.36	588.42	0.00
Panavia F 2.0	Thickness	4705.59	2	2352.79	446.53	0.00
Panavia F 2.0	Color*Thickness	309.03	6	51.51	9.75	0.00
Panavia F 2.0	Measurement time	978.41	1	978.41	321.05	0.00
Panavia F 2.0	Measurement time*Color	565.75	3	188.58	61.88	0.00
Panavia F 2.0	Measurement time*Thickness	64.11	2	32.06	10.52	0.00
Panavia F 2.0	Measurement time*Color*Thickness	163.93	6	27.32	8.96	0.00
Variolink N	Color	1231.2	3	410.4	86.46	0.00
Variolink N	Thickness	4179.4	2	2089.7	440.24	0.00
Variolink N	Color*Thickness	183.8	6	30.6	6.45	0.00
Variolink N	Measurement time	16.5	1	16.5	2.83	0.9
Variolink N	Measurement time*Color	6.2	3	2.1	0.35	0.78

Variolink N	Measurement time*Thickness	2.7	2	1.4	0.23	0.79
Variolink N	Measurement time*Color*Thickness	16.8	6	2.8	0.48	0.82

### Results of Tukey LSD test

Color	Thickness (mm)	Panavia F 2.0		Variolink N	
		1st Day	10th Day	1st Day	10th Day
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
A1	0.5	25.40 (2.46) b	33.50 (3.10) a	39.90 (2.28) AB	40.10 (2.38) A
	1	17.40 (1.43) cg	21.70 (1.16) d	37.10 (1.66) BC	37.10 (3.07) BC
	2	11.60 (1.08) ef	23.80 (2.20) bd	27.50 (1.35) EF	29.50 (2.12) E
A2	0.5	22.20 (1.99) d	24.90 (3.93) b	38.10 (1.91) B	38.60 (1.43) AB
	1	17.10 (1.45) cg	24.10 (3.11) bd	36.30 (2.71) BC	36.70 (2.36) C
	2	10.60 (1.17) e	18.20 (2.04) g	27.70 (2.67) EF	27.90 (1.45) EF
A3	0.5	15.90 (1.73) g	16.90 (2.01) cg	35.80 (1.69) C	36.20 (1.99) BC
	1	7.00 (0.67) hi	7.70 (1.25) i	31.30 (2.67) DE	31.90 (3.51) D
	2	4.50 (2.17) hj	5.50 (2.59) h	27.50 (2.99) EF	27.40 (1.65) F
A4	0.5	12.90 (1.20) f	14.30 (1.06) cf	33.50 (2.72) CD	35.20 (1.62) C
	1	5.20 (1.48) h	6.40 (2.22) hi	28.80 (1.81) EF	29.40 (2.01) E
	2	3.10(1.91) j	4.30 (1.95) hj	24.30 (3.56) G	24.80 (1.40) G

0177

### Effect of Different Fabrication Techniques on Optical Properties of Zirconia-Based Restorations

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**Objectives** The aim of this study was to investigate the effect of different fabrication techniques on the color, translucence, opalescence and fluorescence properties of zirconia-based systems.

**Methods** Sixty disc-shaped specimens (10mm diameter,  $0.5 \pm 0.01$ mm thickness) were fabricated from zirconia blocks. Specimens were randomly divided into 4 groups according to veneering techniques (n=15). Liner was applied to Layering (L), Pressing (P) and Cut-back (CB) groups. Specimens in group L were veneered with nano-fluorapatite veneering ceramic. Specimens in group P were heat-pressed with fluorapatite-glass-ceramic ingots. Specimens in group CB were veneered by partially pressed ingots and subsequently layered with veneering ceramic. For CAD-on (CO) group, veneering ceramics were designed and milled from lithium-disilicate glass-ceramic blocks in CAD/CAM and fused to zirconia by a glass-fusion ceramic and crystallized. Specimens in full-contour-zirconia (FZ) group (n=15) were fabricated from zirconia blocks (10mm diameter,  $1.5 \pm 0.01$ mm thickness). Color parameters ( $L^*a^*b^*$ ) were measured with a spectrophotometer and color difference ( $\Delta E$ ), translucency parameter (TP), opalescence parameter (OP) and fluorescence properties were calculated. The statistical analyses were performed by One-way ANOVA, Kruskal-Wallis, Tukey HSD, Bonferonni ( $P < .05$ ) and Pearson ( $P < .01$ ) tests.

**Results**  $\Delta E$  between the shade guide and groups were significantly different ( $P < .05$ ).  $\Delta E$  for groups listed as  $L > CB > CO > FZ > P$ . There were unacceptable color differences in L and CB groups ( $\Delta E > 3.7$ ). Significant differences were found between TP of the groups ( $P < .05$ ) and listed as  $CO > P > CB > L > FZ$ . There were significant differences between the OP of the groups ( $P < .05$ ) and listed as  $P > CO > CB > L > FZ$ . There were strong correlations between TP and OP values ( $r^2 = .861$ ). Also significant differences were found between fluorescence of the groups ( $P < .05$ ) and listed as  $FZ > L > CO > P > CB$ . There were significant correlations between TP and fluorescence ( $r^2 = .151$ ) and between OP and fluorescence ( $r^2 = .227$ ).



Conclusions Optical properties of zirconia-based systems are greatly affected by the fabrication techniques. Therefore selection of appropriate technique and ceramic type is important for clinical use.

0178

#### **EVALUATION OF OPTICAL PROPERTIES OF ZIRCONIA INFRASTRUCTURE SYSTEMS USING KUBELKA-MUNK ANALYSES**

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##### **Objectives**

Although zirconia ceramics are commonly used due to the high mechanical properties and biocompatibility, the opacity of zirconia inhibits obtaining maximum aesthetic results. The aim of this study was to compare color and translucency properties of zirconia-based infrastructure systems.

Methods Five different zirconia based systems; Rainbow, Rainbow-translucent, Ice Zirkon, Prettau and Lava were evaluated (n=16/group). Discs within each group with 14 mm diameter and 0,5 mm thickness were randomly divided into two groups where half of the specimens (n=8) were veneered with 1mm thick feldspathic porcelain, while the other half (n=8) were left intact. A PR705 spectroradiometer was used to measure spectral radiance, which was converted to reflectance spectra through the use of a reflectance standard. Kubelka-Munk theory was then used to determine the inherent color and translucency parameter (TP) of each zirconia system. Data were statistically analyzed using one-way ANOVA followed by post-hoc Ryan-Einot-Gabriel-Welsch-Q test ( $\alpha=0,05$ ).

Results Statistically significant differences were observed between translucencies of different zirconia core materials ( $P<0,05$ ). Results has shown that unveneered Rainbow-translucent zirconia core specimens showed the lowest translucency values ( $7,4\pm 0,8$ ) while Prettau zirconia core specimens showed the highest ( $12,1\pm 1,1$ ). Similar to the unveneered specimens, for the veneered groups the lowest and the highest TP values were obtained for Rainbow-translucent ( $4,0\pm 1,4$ ) and Prettau zirconia groups ( $6,0\pm 0,3$ ), respectively.

Conclusions Within the limitations of this study, it can be concluded that Kubelka-Munk theory can be used to determine the translucency parameter. For clinical applications; when the tooth adjacent to the restoration is translucent, a higher translucency material is preferred. When a restoration with high opacity is needed to mask any discolored structures, a lower translucency zirconia ceramic is preferred.

0179

Internal and marginal precision of fit of zirconia single crowns produced via digital and conventional impression methods - a clinical comparative study

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Objectives This study focused on the clinical investigation of internal and marginal fit of CAD/CAM-fabricated zirconia single crowns produced via conventional and digital impression technique.

Methods In 20 patients a total of 40 zirconia single crowns were inserted in a private practice after informed consent. Therefore a circumferential reduction with a 1.0 mm chamfer finish line and an occlusal reduction of 1.5 mm were realised. Conventional impressioning with a silicone (Aquasil Monophase, Aquasil XLV; Dentsply, Konstanz, Germany) and intraoral scanning (Cara TRIOS; Heraeus, Hanau, Germany) of each of the preparations was performed and two respective zirconia copings per tooth were produced. The marginal and internal fit of the restorations was evaluated employing a replica technique. For statistical analysis pairwise comparison (Wilcoxon-Rank-Test) was performed.

Results Zirconia single crowns produced via digital impression technique revealed statistically significant better precision of internal fit in specific areas (chamfer area and occlusal area). The Evaluation of marginal fit showed no significant differences between the two groups of digital and conventional impression technique. Within the group of digital impressioning some areas showed significant better precision of internal fit when specific areas were compared. Within the group of conventional impressioning these differences were found for marginal gaps. All restorations of both groups offered internal and marginal gaps within the postulated clinical tolerance ranges. Conclusions CAD/CAM-fabricated zirconia single crowns produced via digital or conventional impression techniques offer adequate marginal and internal precision. Digital impression technique provides lower internal gaps in some specific areas.

**0180**

**INNER FERRULE EFFECT - NEW APPROACH TO A CONTEMPORARY CONCEPT**

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**Objectives** Loss of dentin increases the chances of fracture occurrence during functional loading, compromises the fracture resistance of root treated teeth and the retention of subsequent post and core restoration. Therefore, the longevity of an endodontic treated tooth is directly related to the amount of remaining tooth material.

This article aims to reanalyze the concept of ferrule by looking at other aspects (inner ferrule) of this already accepted concept, and proposes a paradigm shift in the way it is thought of and utilized.

**Methods** A total of 36 extracted caries free maxillary central incisors were sectioned 2mm above the cement-enamel junction and root treated. The teeth were prepared with inner dentin shoulder and divided into following groups: A (0 mm), B (1 mm), and C (2 mm). The specimens were restored using Y-TZP posts and e.max core. The specimens (n=12/gr) were embedded in acrylic resin blocks, loaded until fracture (1mm/min) at angle of 45° and statistically analyzed (ANOVA, Tukey test, p<0.05). Failure patterns were analyzed using optical microscope.

**Results** For groups A to C, the results (N) were as follows: 519.4±51.9, 543.6±73.7, and 795.3±153.3. Significantly lower failure loads were measured for the groups with 0 mm and 1 mm ferrule, compared to those with 2 mm.

Failure patterns within the groups A, B, and C, revealed non-catastrophic failure in 93%, 92, and 85%.

**Conclusions** The teeth prepared with 2 mm inner ferrule show highest value of fracture resistance. Within the limitations of this in vitro study, it can be concluded that the inner ferrule increases the fracture resistance of root treated central maxillary incisors restored with the first full ring in the coronal part of the Y-TZP post.

**0181**

**Caries Development from 2 to 5 years of Age**

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University of Oslo

**Objectives** The objective was to study associations between dental health and oral health behaviour at 2 years of age and caries development from 2 to 5 years.

**Methods** The study population consisted of 211 children followed from 2 to 5 years of age. Dental examinations were conducted at the student dental clinic at the University of Oslo. Parents filled in a questionnaire about family background and oral health behaviour as part of the dental examination at 2 years of age. Non-western background was reported in 24% of the children. Caries experience and the presence of dental plaque at the clinical examinations at 2 and 5 years of age were extracted from the children's dental records. Data were cross-tabulated and tested with Chi square statistics.

**Results** At 2 years of age, 7% of the children had visible dental plaque and 7% had caries. Half of the children (56%) had the teeth brushed twice daily, tooth brushing was introduced when the child was 7 months or older in 65% of the children, and 18% of the children were offered sugary snacks daily. At 5 years of age 29% of the children had caries experience (d1-5mft > 0). Non-western background, tooth brushing less than twice daily and being offered sugary snacks daily at 2 years of age were related to caries development from 2 to 5 years. At 5 years of age, the number of decayed teeth was higher in children diagnosed with visible plaque at 2 years than in children without visible plaque (4.6 teeth vs. 0.8 teeth, p < 0.01), and higher in children having caries at 2 years than in children without caries at 2 years (6.5 teeth vs 0.6 teeth, p < 0.01).

**Conclusions** Dental health at 2 years of age could be used as indicator for caries development from 2 to 5 years. Children with caries, visible dental plaque or unfavourable oral health behaviours at age 2 years developed statistically significantly more caries than other children during preschool age, and require individualized caries prevention to reduce further caries increment.

0182

### **Comparing the Effectiveness of Three Different Retraction Methods on Patient's Comfort**

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**Objectives** The aim of this in vivo study was to evaluate the patient's comfort, bleeding and sensitivity to and the displacement outcome of 3 different gingival displacement methods using Visual Analogue Scale (VAS).

**Methods** A total of 110 patients with healthy gingiva who needed fixed partial dentures were included in the study and divided into 3 groups randomly. After 0.5 mm subgingival preparation with a chamfer finish line, group 1 received conventional retraction cord (Ultrapak®) only, group 2 received cord embedded in AlCl<sub>3</sub> (Racestypine, SEPTODONT®) and group 3 received retraction paste (3M ESPE Astringent Retraction Paste®) prior to final impression. Immediately after provisional restoration, 7 questions were assessed at baseline and 7 questions were assessed at 1, 7, 28 days. Data was analyzed using Kruskal-Wallis, Mann-Whitney U, Ki Square tests and the Bonferroni correction test ( $\alpha = 0.05$ ).

**Results** The displacement amount, working time, bleeding after application and patient's comfort were statistically significant among the groups ( $p < 0.001$ ). Group 3 showed better results for working time and patient comfort ( $p < 0.001$ ). Sensitivity was reduced for all groups after 7 and 28 days. Group 2 showed better results for displacement quality ( $p = 0.003$ ). The highest score for bleeding after application was in Group 1. Group 2 and 3 were found to be comparable in terms of bleeding.

**Conclusions** Cordless technique (retraction paste) was clinically useful to save time and enhance patient comfort and it caused less bleeding and sensitivity.

0183

### **ORAL HEALTH STATUS OF 3-6 YEARS-OLD NURSERY CHILDREN, TURKEY**

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**Objectives** In this study, it was aimed to determine some socio-demographic characteristics, oral hygiene practices, oral habits, feeding habits and oral health status of nursery children.

**Methods** The ethical approval of Hacettepe University and the written informed consent of the parents were obtained before the data collection. Eleven public nursery schools in one low-middle socio-economical level districts of the capital city of Turkey (Ankara) were covered; the data were gathered via a structured, pre-tested questionnaire from 729 parents and children's oral examinations were done in the field conditions by a research assistant of Pediatric Dentistry Department. The oral health status was evaluated by using dmft, dmfs, D0-D4, ICDAS II, pufa, dental plaque and gingival indices. Furthermore, posterior, anterior and canine occlusion, dental anomalies, anthropoid diastemas and crowding existence were also evaluated.

**Results** Of the 729 children, 55.4% was male; mean age was  $58.8 \pm 8.6$  months; mean dmft was  $4.8 \pm 4.7$  ( $4.6 \pm 4.6$  in females,  $5.0 \pm 4.8$  in males) and the mean dmfs was  $8.3 \pm 10.2$ . 538 children (73.8%) had early childhood caries (ECC) while severe ECC was 51.0%. Only 23 boys and 35 girls had totally healthy primary teeth according to D and ICDAS II. Of all children, 17.1% had initial, 28.0% had moderate and 46.9% had extensive decay according to ICDAS II. 64 boys and 31 girls had symptoms due to pufa index; a total of 180 teeth had clinical consequences of untreated dentine carious lesions. The mean plaque and gingival indices were  $0.31 \pm 0.32$  and  $0.08 \pm 0.16$ , respectively.

**Conclusions** In conclusion, pre-school children enrolled to the public nursery schools in a low-middle socio-economic level district in Turkey had high prevalence of carious lesions and there is an urgent need of preventive programs in the area.

**0184**

**Evaluation of a School-Based Fluoride Varnish Programme in Sweden with Focus on Caries Prevention and Cost Effectiveness**

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**Objectives** To evaluate a school-based fluoride varnish programme (FVP) for 12-15 year-olds, partly implemented in 2003 and fully implemented in 2009, in Region Västra Götaland, Sweden, with focus on caries prevention and cost effectiveness.

**Methods** Caries data from the dental records in the Public Dental Service's (PDS) for three groups were compared. Group 1 (n=3500) and Group 2 (n=15629) were born the same year. Group 1 had taken part of a FVP and Group 2 acted as the control. Those groups were compared to Group 3 (n=12189), adolescents born 5 year later which all had taken part of a FVP. All adolescents had been examined at the PDS, which in this region consisted of totally 138 clinics. In the FVP, the adolescents met dental personnel at school for fluoride varnish applications (Duraphat®, 2.26% F) every sixth month from 6<sup>th</sup> to 9<sup>th</sup> grade. Furthermore, the adolescents participated in two lessons focusing on oral health and tobacco use. More than 95% of all classes in the region participated and the cost was estimated to 100 SEK (12 USD) per adolescent and year. Means and standard deviations were calculated for all groups and the differences were tested by General Linear Model.

**Results** The changes in mean DFSa from 12 to 15 years were 0.188 for Group 1, 0.300 for Group 2 and 0.198 for Group 3. The GLM-model showed statistically significant differences within groups and also between the groups over time (p<0.001), indicating a lower caries increment for Group 1 and Group 3 which took part in the FVP. The cost gain due to decreased number of fillings was higher than the total cost of the intervention.

**Conclusions** This study showed that the caries increment from 12 to 15 years was significantly lower after the implementation of FVP. In a short perspective, the FVP was cost-effective and considering a longer perspective each prevented filling is possibly also a saving from both the individual and society perspectives.

**0185**

**Treatment of vital, deeply carious teeth: A retrospective practice-based cohort study**

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**Objectives** Maintaining pulpal vitality and achieving long-term restoration success is challenging when treating deep caries lesions, whilst has not been not been evaluated so far. We aimed at assessing success, survival and influencing factors of treating deep lesions in general dental practice.

**Methods** Patient-record databases from six private practices in Germany were assessed. Permanent posterior teeth with lesions radiographically extending into the inner dentin with sensible, asymptomatic pulps were retrospectively evaluated. Outcome parameters were success (absence of re-treatment) and survival (absence of extraction). Mean success and survival times were estimated using Kaplan-Meier curves, and effect of treatment modifiers assessed using Cox regression.

**Results** 232 patients (mean age 28) with 308 teeth (62% molars) were evaluated over a mean of 74 (range: 0-333) months. 35% of teeth experienced pulpal exposure leading to direct capping. Most restorations were multi-surfaced and used amalgam (47%) or composite resins (35%). 142/308 teeth failed (mean [95% CI] success time: 130 [112/147] months), requiring restorative (54%) or endodontic (37%) re-treatments. Risk of failure was increased in patients aged ≥ 40 years (Hazard Ratio [95%CI]: 2.06 [1.31/3.07]), teeth restored with glass ionomer or other cements (HR: 1.67 [1.04/2.67], and teeth with pulp exposure (HR: 1.45 [1.00/2.11]). Only 13 teeth required extraction (survival time: 307 [391/324] months). Extraction occurred >10-fold more often in teeth restored using cement materials.

**Conclusions** Teeth with deep lesions had high risk of failure, whilst risk of extraction was low. Avoiding pulpal exposure and immediately placing definitive restorative materials could reduce risk of failure.

0186

**Sugar alcohols as sweeteners - one way to prevent dental caries**

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**Objectives** The purpose of this study was to compare the effect of sugar alcohols on caries prevention.

**Methods** The effect of different sugar alcohols (erythritol, xylitol, and sorbitol as a positive control) on the development of dental caries in the mixed dentition was observed and compared among 475 elementary school pupils (from 10% of all municipal schools in this area), randomly allocated into three intervention groups. The mean age of the pupils was 8.3 years (SD=0.38). The daily dose of 7.5 g sugar alcohols in the form of lozenges was administered three times during all school days (approximately 200 days in a year). This 3-year prospective, randomized, double-blind, clinical intervention study was approved by the Research Ethics Committee of the University of Tartu (166/T-7) and was registered on NIH (NCT01062633).

**Results** Only few new dentine caries lesions developed in all groups during the intervention. After the first year of the intervention, caries experience (DMFT) decreased in all groups. After the second year it further decreased in the erythritol group. The differences between the groups were, however, not statistically significant. Caries experience (dmft) also decreased in the primary teeth; the biggest decline was found in the erythritol group. This difference was statistically significant compared to the sorbitol and the xylitol groups after the first and the second year of the intervention.

**Conclusions** The number of new dentine caries lesions in the mixed dentition was low in all groups throughout the study. Erythritol had a statistically significant effect on caries reduction in primary teeth.

0187

**Can calcium phosphate improve glass ionomer cements?**

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**Objectives** To investigate the structure and strength of a glass ionomer cement modified by calcium phosphate.

**Methods** Two ionomer cements were investigated: a commercial one (VOCO Ionofil Molar AC), where a powder of aluminium silicate glass particles was mixed with a polyacrylic acid solution, and an experimental cement, where 8% weight of the powder was replaced by calcium phosphate. The commercial and experimental cements were mechanically mixed for 15 s in a powder to liquid ratio of 3.6:1 g. Structural changes during cement maturation were assessed with X-ray (micro-CT), neutron tomography, as well as nitrogen gas adsorption experiments. Micro-CT and neutron tomography are sensitive to pores on the micrometer scale, while nitrogen adsorption can detect pore changes in the nanometer scale. Strength was assessed using the biaxial flexural strength test. The samples were stored at 37°C in water up to 32 days, except for the nitrogen gas adsorption experiments where samples were stored dry.

**Results** The experimental cement containing calcium phosphate demonstrated reduced porosity at the micrometer scale but increased porosity at the nanometer scale, when compared with the commercial cement. An inhomogeneous hydrogen distribution within the experimental cement was observed from the neutron tomography results. Moreover, the incorporation of calcium phosphate did not improve the strength of the experimental cement. In contrary, a decrease in strength was registered after 32 days.

**Conclusions** By replacing 8% weight of the glass ionomer powder with calcium phosphate, the structure of the cement was modified with no benefit for its strength. The structural changes at the nanometer scale seem important for the mechanical strength of the investigated glass ionomer cements.

**0188**

**EFFECT OF COMMON ACIDIC BEVERAGES ON THE SURFACE ROUGHNESS OF GLASS IONOMER-BASED RESTORATIVE MATERIALS**

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Yeditepe University

**Objectives** The aim of this in-vitro study was to compare the effect of different immersion regimes in acidic media on the surface roughness of various glass ionomer-based restorative materials.

**Methods** The total number of 200 specimens were prepared from 5 different restorative material group; Group I: GCP Glass Fill, Group II: Fuji IX GP (GC America), Group III: ChemFil Rock (Dentsply), Group IV: F2000 (3M ESPE), Group V: Dyract XP (Dentsply). Ten specimens from each group were then immersed into one of the tested beverages including; Coca-Cola, Ice-Tea, orange juice and distilled water (control). Each immersion lasted for 24 hours and solutions were renewed each day. The immersion protocol was repeated for 7 days. Surface roughness measurements were performed at baseline and after 7 day-immersion period for each group.

**Results** ChemFil Rock and F2000 materials had significantly increased roughness values following immersion at all the acidic beverages as well as distilled water. Dyract material had significantly increased roughness value with all acidic beverages whereas the increased roughness value of Fuji IX material was found after Coca-Cola immersion. GCP Glass Fill material did not have any significant increase after the immersion at distilled water or acidic beverages ( $p < 0.05$ ).

**Conclusions** In conclusion, GCP Glass Fill that includes nano-fluoride/hydroxyapatite particles was determined as the most robust material comparing the surface roughness of the other restorative materials particularly used in pediatric dentistry. The use of this new innovative restorative carbomised glass cement might be promising for the restoration of primary teeth although there is need for further studies for evaluating the other physical properties of these materials.

**0189**

**A randomised, controlled, split-mouth trial evaluating the clinical performance of a high viscosity glass ionomer restorations in non-carious cervical lesions: 1 year results**

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Izmir Katip Celebi University

**Objectives** The aim of this randomised, controlled, single-centre, split mouth clinical trial was to compare the clinical performance of high viscosity glass ionomer restorations in non-carious cervical lesions in comparison with nanohybrid composite restorations applied with a three-step etch & rinse adhesive system.

**Methods** A hundred and thirty four non-carious cervical lesions were included and assigned into two groups, according to the split mouth design. The cervical lesions in experimental group were restored with a high viscosity glass ionomer (EQUIAFil, GC); while a nanohybrid composite (G-aenial, GC) with a three-step etch & rinse adhesive system (Optibond FL, Kerr) was applied to the control group. All tested restorative materials were used according to the manufacturers' instructions. Clinical evaluation was performed after 1 week, 6 months and 1 year using FDI criteria. Data were analysed using Friedman 1-way and Mann-Whitney U tests ( $\alpha = 0.05$ ).

**Results** After 1 year, high viscosity glass ionomer restorations revealed a retention rate of 96% in comparison to 100% of nanohybrid composite restorations. Considering all criteria, there were no significant differences between the two restorative materials.

**Conclusions** The clinical performance of high viscosity glass ionomer restorations in non-carious cervical lesions was found similar to the nanohybrid composites after 1 year of clinical service.

0190

**Retention of thermo-cured glass ionomer and resin-based fissure sealant - a comparative clinical study**

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**Objectives** The aim of this study was to investigate retention of thermo-cured highly viscous glass ionomer (GIC) fissure sealant after one year of clinical trial. Recent studies showed that application of heat during setting of glass ionomer cements (GIC) can improve mechanical properties of material. This also might improve retention rate of GIC sealant. The purpose of this study was to assess retention rate of GIC fissure sealants heated during setting time.

**Methods** Eighty teeth with well-delineated fissure morphology divided in two groups were sealed with highly viscous glass ionomer (Fuji Equia Fil, GC) and Heliaseal F (Vivadent, Liechtenstein) using split mouth design. Heliaseal F was placed and set according to manufacturers instruction using polymerization unit Bluephase 16i (Vivadent, Liechtenstein). GIC was heated with external heat source (Bluephase 16i, Vivadent, Liechtenstein) during setting time. Teeth in group A were sealed with Fuji Equia Fil and in group B with Heliaseal F. Replicas of occlusal surfaces sealed with Fuji Equia Fil were analysed with SEM (Scanning Electron Microscope (SEM) (XL30, Philips, Eindhoven, The Netherlands)). To obtain replicas, the impression with a polyvinyl-siloxane impression material was taken and poured in acrylic resin (ClaroCit Kit, Struers A/S, Ballerup, Denmark).

**Results** Retention rate in group A was 75% after one year of clinical service. Group B showed retention rate of 82.5%. There was no secondary caries lesions in either group. Difference between retention rate of thermo-cured highly viscous glass ionomer and resin sealants was not statistically significant. Thermo-cured glass ionomer showed comparable retention rate when compared with a resin based sealant. SEM analysis showed good surface adaptation without a clear transition between GIC and the enamel.

**Conclusions** The heating procedure during setting of GIC sealants could be recommended as routine clinical practice. Future studies are required to examine the long-term performance of thermo-cured highly viscous glass ionomer sealants.

0191

Fracture strength of restorations in proximal cavities of primary molars

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**Objectives** The present study evaluated the fracture strength of various restorative materials in both dovetail and box-only class II cavity designs of primary molars.

**Methods** Eighty extracted noncarious human primary molars were used. The teeth were randomly divided into two groups for either dovetail or box-only preparations. The teeth were then divided into three subgroups for each restorative material: glass ionomer cement (GIC), resin-modified glass ionomer cement (RMGIC), and compomer. The restorations were tested for fracture strength. The loads at fracture and fracture mode were recorded and scanning electron microscopy analysis was performed to observe the micromorphology of the interfaces between the teeth and the materials. The nonparametric Kruskal-Wallis and Mann-Whitney U-tests were used.

**Results** There were significant differences between the restorative materials ( $p < 0.05$ ), there were no differences between the fracture strength of the box-only and the dovetail cavity designs in any of the three groups ( $p > 0.05$ ). The fracture strength of the compomer groups was significantly higher than that of the GIC and RMGIC groups ( $p < 0.05$ ).

**Conclusions** Class II cavity could be selected as dovetail or box-only and compomer is more resistant to fracture than GIC and RMGIC.

0192

### **EFFECT OF ARTIFICIAL AGING ON THE COMPRESSIVE STRENGTH OF VARIOUS FLUORIDE RELEASING RESTORATIVE MATERIALS**

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Yeditepe University

**Objectives** The aim of this in-vitro study was to evaluate the effect of artificial aging on the compressive strength of various fluoride releasing restorative materials particularly used in pediatric dentistry.

**Methods** A total number of 120 specimens were prepared from the tested restorative materials; [High viscosity glass ionomer; Equia (GC), ChemFil rock (Dentsply), Resin-modified glass ionomer; Vitrebond (3M), Polyacid-modified composite resin; Dyract (Dentsply), and Twinky Star (VOCO)]. All materials were handled according to manufacturers' instructions. ISO standardized specimens were prepared from each material and then stored in distilled water for 24 hr for the first and 7 days for the second experimental period. The compressive strength measurements were performed following the storage periods.

**Results** The 1<sup>st</sup> and 7<sup>th</sup> day compressive strength measurements were recorded. Vitrebond and Twinky Star materials were found to have significantly higher compressive strength values after aging for 7 days ( $p < 0.05$ ).

**Conclusions** In conclusion, the compressive strength values of the resin modified glass ionomer and one of the polyacid modified composite resins were found to be increasing after aging for 7 days. As this parameter is one of the material physical indicators of restorative materials, the increase of compressive strength might be a preferable consequence. These two materials may be preferred for the primary teeth restorations considering the limited time of these teeth in the oral cavity although further studies are required to compare the other physical properties of these materials.

0193

### **Oral Polymorphonuclear Neutrophil Phenotype In Edentulous Subjects**

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<sup>1</sup>ACTA, <sup>2</sup>ACTA

**Objectives** In dentate subjects it is thought that oral polymorphonuclear neutrophils (oPMNs) originate mainly from the gingival crevices. However, the functional status and potential role of oPMNs in the maintenance of oral health is greatly unknown in edentulous subjects. Therefore, the aim of this study was to characterize oPMN counts, activation status and ROS production in edentulous subjects, compared to dentate subjects.

**Methods** oPMNs were purified from oral rinse samples collected from 20 edentulous and 20 dentate subjects. Cell counts were analyzed using a Merck Millipore Muse cell analyzer. Activation status was assessed by cellular expression of CD11b, CD63, and CD66b. Reactive oxygen species production (ROS), with and without stimulation by *Fusobacterium nucleatum* (*Fn*), was determined using Dihydrorhodamine 123 and flow cytometry.

**Results** oPMN counts were present in edentulous in sizeable numbers ( $0.7 \pm 0.7 \times 10^6/\text{subject}$ ), however about 2 fold less compared to dentate subjects ( $1.5 \pm 1.6 \times 10^6/\text{subject}$ ,  $p < 0.05$ ). The expression of CD11b, CD63 and CD66b was lower on oPMNs from edentulous (CD11b  $0.9 \pm 2.3 \times 10^4$ ; CD63  $0.8 \pm 1.4 \times 10^4$ ; CD66b  $2.4 \pm 4.7 \times 10^4$ ) compared to dentate subjects (CD11b  $6.4 \pm 2.9 \times 10^4$ ,  $p < 0.05$ ; CD63  $3.1 \pm 2.5 \times 10^4$ ,  $p < 0.05$ ; CD66b  $10.1 \pm 4.8 \times 10^4$ ,  $p < 0.05$ ). In response to *Fn* stimulation, no upregulation of ROS production was observed in oPMN from edentulous (unstimulated  $8.7 \pm 10 \times 10^5$ ; *Fn*  $6.9 \pm 8.8 \times 10^5$ ,  $p > 0.05$ ), whereas ROS levels were upregulated in oPMNs from dentate (unstimulated  $8.4 \pm 10 \times 10^5$ ; *Fn*  $23 \pm 16 \times 10^5$ ,  $p < 0.05$ ).

**Conclusions** In the edentulous, low oPMN numbers were observed. These cells seem more exhausted, with little functional potential when compared with dentate subjects. The reduced oPMN potential might increase the susceptibility of edentulous subjects towards development of oral infections or other diseases.



0194

**Oral biofilm regrowth after AirFloss Ultra treatment, comparison to floss and the original AirFloss**

Gottenbos, B., Williams, Q., van de Ven, C., Hoetzel, S.

Philips Group Innovation

**Objectives** The Philips Sonicare AirFloss Interdental (AF-Or) employs a microburst of air and water droplets for interdental cleaning, and has been available for some years. Recently a second generation, the AirFloss Ultra (AF-UI) was introduced, clinically proven as effective as floss for gum health, when used with mouthwash. To study the underlying mechanisms of the clinical observations, we have investigated the removal and regrowth of plaque biofilm after AF-UI treatment compared to dental floss and AF-Or *in vitro*.

**Methods** Saliva/plaque based oral biofilms (n=15/group/analysis time) containing periopathogens from the red and orange Sokranksy complexes were placed in a model interproximal space at a proximal surface, partially below the (artificial) gum line. After treatment they were regrown for 24h. Treatments: non-treated control; floss; AF-Or or AF-UI, used with water, Listerine (Lis) or BreathRx (BRx) mouthwash. qPCR was used to determine the total amount and the amounts of specific red and orange complex bacteria. Biofilms were imaged using optical coherence tomography (OCT) and confocal laser scanning microscopy (CLSM).

**Results** AF-UI treatment left only very thin layers of biofilm, invisible for OCT (see figure 1). Viability staining showed on the CLSM that mouthwashes killed many remaining cells. 24h after treatment AF-UI groups had statistically significantly less bacteria than floss and AF-Or treatments, with Lis being significantly better than water or BRx (see figure 2). Red complex bacteria were significantly more reduced when using AF compared to floss, with a complete absence for AF-UI BRx. Orange complex bacteria amounts were significantly lower for AF-UI compared to both floss and AF-Or.

**Conclusions** On this *in vitro* model of dental plaque AirFloss Ultra shows superiority to dental floss and AirFloss Interdental in having lower plaque biofilm amounts with lower levels of periopathogens 24h after treatment, which may explain the excellent clinical results seen on gum health improvement.

0195

**Members of oral biofilms: to inhibit or to be inhibited?**

Rodriguez Herrero, E.<sup>1</sup>, Slomka, V.<sup>1</sup>, Hernandez-Sanabria, E.<sup>2</sup>, Bernaerts, K.<sup>3</sup>, Boon, N.<sup>2</sup>, Teughels, W.<sup>1</sup>

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**Objectives** The objectives of this study were to identify beneficial species which can antagonize the growth of the main periodontopathogens, to determine the antimicrobial substances which are involved in these inhibitory activities and to evaluate the influence of environmental factors on the magnitude of these inhibitions.

**Methods** The spotting technique, a competitive assay which consists of inoculating two spots of competing bacteria nearby, was used to detect and quantify inhibitory effects of 14 commensal bacteria on 3 periodontopathogens. The amount of inhibition was quantified by measuring the distance between the edge of the commensal spot and the edge of the spot of the pathogen. Different techniques were used to determine the relative contribution of bacteriocins, acids and H<sub>2</sub>O<sub>2</sub> production. Sequence of inoculation and the effect of environmental conditions were analyzed as determining factors for the amount of inhibition.

**Results** Of the 14 tested commensal species, only 6 streptococcus species could antagonize the growth of the periodontopathogens. For these 6 species, H<sub>2</sub>O<sub>2</sub> production was the most important inhibitory mechanism. Inhibition was only observed when the commensal species were inoculated prior to the pathogens. The inhibitory effect was strictly regulated by environmental factors: oxygen availability, cell density and nutritional depletion were crucial for the competition and coexistence between the commensal and pathogenic species.

**Conclusions** Due to their inhibitory effects, 6 commensal species could be classified as beneficial bacteria. Their primary mode of interaction was H<sub>2</sub>O<sub>2</sub> production. Although H<sub>2</sub>O<sub>2</sub> production is highly regulated by environmental factors, it might have a much more important role on biofilm development and composition than previously anticipated.

0196

**β-Methyl-D-galactoside: the first potential prebiotic for oral health?**

Slomka, V.<sup>1,2</sup>, Rodriguez Herrero, E.<sup>1</sup>, Hernandez-Sanabria, E.<sup>2</sup>, Boon, N.<sup>2</sup>, Quirynen, M.<sup>1</sup>, Teughels, W.<sup>1</sup>

<sup>1</sup>KU Leuven, <sup>2</sup>Ghent University

**Objectives** It has been shown that several commensal bacteria can inhibit the growth of pathogenic bacteria and attenuate the associated inflammatory response. Nutritional stimulation of these, so called, “beneficial bacteria” via prebiotics might therefore provide a health benefit. Currently there are no known prebiotics for oral health. The aim of this study was to identify prebiotic substances that can selectively stimulate the growth of beneficial bacteria and thereby suppress the growth of oral pathogens.

**Methods** Six oral pathogenic and 9 commensal/beneficial bacteria were screened for their ability to metabolize 95 different carbon substrates. The substrate demonstrating the best metabolically stimulatory effect on beneficial bacteria without stimulating the pathogenic species was further investigated. Growth curves and single species biofilms were established in order to verify and translate the metabolic stimulation to bacterial growth promotion and increased biofilm formation. The prebiotic effect was verified in dual-species growth and biofilm experiments containing beneficial and pathogenic bacteria. The experiments were analyzed using OD, crystal violet staining and vitality qPCR. Each experiment was repeated at least 3 times.

**Results** β-Methyl-D-galactoside was identified as a potential prebiotic since it stimulated the metabolic activity (factor 7.7), growth (factor 2.0) and biofilm formation (factor 10.5) of *Streptococcus salivarius* without having any effect on the tested pathogens. The dual-species experiments showed clear reductions in the proportion of pathogens in both liquid culture assays and biofilm assays when β-Methyl-D-galactoside was added to the cultures.

**Conclusions** Selective stimulation of beneficial bacteria in dual-species communities is thus possible at an in vitro level. Such stimulation results in a reduction of pathogens. These observations support the hypothesis that by nutritional stimulation of beneficial bacteria, a microbial community can be shifted towards a more health associated composition. β-Methyl-D-galactoside could be the first known oral prebiotic, if the data can be confirmed at multi-species levels.

0197

**Does saliva contain an adiponectin-like imposter?**

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**Objectives** Serum adiponectin is secreted from adipocytes and may influence insulin resistance, inflammation and cardiovascular system. It has anti-inflammatory properties and may exert on obesity and related diseases. Decreased levels of plasma adiponectin were found in obese patients resulting in an increased level of infections, for example periodontitis.

Although adiponectin was considered to be synthesized and secreted exclusively by adipocytes and detected in blood, it is also present in other, less invasive, body fluids such as saliva and gingival crevicular fluid (GCF).

**Objectives:** this study aims to determine the sources of adiponectin and the challenge of its detection.

**Methods** Methods: from healthy adult volunteers, unstimulated whole mouth saliva (UWMS) was collected for 5 minutes; GCF was collected using a periopaper inserted 1 mm below the free gingival margin for 30 seconds. Blood was obtained by a finger prick and collected using sialostrip. Adiponectin was detected by immunoblotting, enzyme linked immunosorbant assay (ELISA), and multiplex array.

**Results** Results: in immuno-blotting, after loading samples and standard under heating and reducing conditions, monomer adiponectin was seen at 30KDa in blood and standard. However, in saliva a single positive band was found at different molecular weight of purified adiponectin. ELISA showed positive results in saliva and GCF but not in serum. In contrast multiplex array showed the highest concentration of adiponectin in blood, less in GCF and the least in saliva.

**Conclusions** Conclusion: salivary adiponectin has a small contribution from serum via the GCF but there also appears to be a contaminating protein which reacts with several antibodies (in western blots and ELISAs) which is unlikely to be adiponectin. It is yet to be shown whether this imposter has biological activity.

0198

**Neural influence on salispheres development**

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**Objectives** Salispheres are spheroid hetero-cellular non-adherent clusters, which form *in vitro* from dissociated salivary gland cells. Selected cells isolated from salispheres contribute decisively to the recovery of experimental-induced atrophic salivary glands. However, the properties of salispheres change after five days in culture, seriously diminishing their inductive potential. It is critical to understand why salispheres become dormant in tissue culture. The main aim of this study is to assess whether neural factors affect salispheres formation and development. **Methods** We harvested submandibular glands from adult female mice (ICR strain) under terminal anesthesia and processed them by mechanical and enzymatically digestion. The morphology of cells has been examined for ten days from plating under phase contrast microscope (cell number, size, morphology and aggregating properties). Neural mediators (atropine, carbachol, substance P and VIP) have been selectively added to the cell culture. **Results** Salispheres development was influenced by different neural mediators. Most salispheres formed in an atropine-enriched microenvironment were slightly smaller compared to the control (57.03mm vs. 76.41 average diameter in Day 4). Adherent properties of salispheres were increased in the substance P-treated group (approx. 10% of Day 4 salispheres had already stuck), and occasional mixed aggregates of salispheres and adherent cells were encountered.

**Conclusions** This study showed that neural mediators influence the developing pattern of salispheres formation *in vitro*. By modulating the culture microenvironment, the results of using salispheres in salivary gland regeneration might be enhanced.

0199

**Effect of Increased TNF- $\alpha$  Plasma Level on Orthodontic Induced Inflammatory Root Resorption**

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**Objectives** TNF- $\alpha$  is a cell signaling protein (cytokine) involved in systemic inflammation and is one of the cytokines that make up the acute phase reaction and is produced chiefly by activated macrophages. The objective of this study was to determine if increased TNF- $\alpha$  plasma level has any effect on induced inflammatory root resorption. **Methods** Forty male Wistar rat weighting 200-250 g were selected and randomly divided into four groups of ten. On the day 0, blood sample were taken from all animals and orthodontic appliances were placed for two groups that consisted the Stress-Experiment and Non-Stress (Positive Control) Experiment group. No appliances were placed for two remained groups (Stress Control and Negative Control) and considered for blood samples and root histologic comparison. One of these groups was exposed to stress and the other one was under standard laboratory condition. The orthodontic appliance consisted of a NiTi closed coil spring ligated to first upper right molar and incisor, exerting a 60 gr force during twenty-one-day experimental period, after which the animals were sacrificed and blood samples were taken from all of the rats. Palatal halves of two first groups were removed for histological examination and for calculation of the amount of root resorption. Blood samples were evaluated for Corticosterone and TNF- $\alpha$  plasma levels by ELISA method. Kruskal Wallis nonparametric test in SPSS statistical package was used for the purpose of comparison.

**Results** Statistical analysis showed that there was a significant increase in TNF- $\alpha$  plasma levels within twenty one days. A significant difference ( $p < 0.01$ ) in root resorption and tooth movement was observed between the control and stress groups.

**Conclusions** An increased TNF- $\alpha$  in plasma following exerting stress condition is correlated to orthodontic induced inflammatory root resorption.

0200

**Expression of Slc26a3 and Slc26a6 in mouse ameloblasts during amelogenesis.**

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**Objectives** Formation of apatite crystals during enamel development generates protons. To sustain mineral accretion maturation ameloblasts need to buffer these protons. The presence of cytosolic carbonic anhydrases, the basolateral Na<sup>+</sup> bicarbonate cotransporter Nbc1 and basolateral anion exchanger Ae2a,b in maturation ameloblasts suggest these cells produce and import bicarbonates but it is unknown by which mechanism bicarbonates are secreted into the enamel space. We tested the hypothesis that maturation ameloblasts express Slc26a3/Dra and Slc26a6, members of the solute carrier family 26A (SLC26A) that secrete bicarbonate into the enamel space in exchange for Cl<sup>-</sup>.

**Methods** Tissues for histology were collected from Erupted teeth of 2 month Old mouse . Fixed and paraffin embedded samples from erupted teeth of mouse were retrieved with proteinase K solution (10 µg/ml) in phosphate buffered saline (15 min, 37°C) and incubated with primary antibodies(rabbit antiSLc26A3). Freeze-dried enamel organs from lower incisors and kidney used for western-blotting and micro-CT analysis.

**Results** Both members were immunolocalized in ameloblasts, principally at maturation stage. Mice with null mutation of either *Dra* or *Slc26a6* had a normal dental or skeletal phenotype without changes in mineral density as measured by microCT. In enamel organs of *Slc26a6* null mice both Dra and pendrin protein were elevated. The amount of Slc26a6 protein was unchanged in enamel organs of *Ae2a,b*-null and *Cftr*-null mice but reduced in *Slc26a3*- null mice.

**Conclusions** The data show that ameloblasts express Slc26a3/Dra and Slc26a6 during maturation stage amelogenesis but each individually are not critical for formation of dental enamel. The upregulation of Slc26a3 and pendrin in *Slc26a6*-null ameloblasts and downregulation of Slc26a6 in *Dra* null ameloblasts suggests that in ameloblasts Slc26a members can compensate for each other and may transport Cl/HCO<sub>3</sub> with the same stoichiometry as in pancreatic duct epithelium.

0201

**Occlusal Centroid: Reliable Landmark to Measure Maxillary Posterior Tooth Movement**

Simon, G., Keeling, A.

University of Leeds

**Objectives** There is a need to develop a more clinically intuitive and reproducible method for quantifying tooth movements.

**Objectives:** To develop a method for finding the centre of the occlusal surface (centroid) on a digital 3D scan, and test its repeatability. To investigate the reliability of this landmark when measuring tooth movements.

**Methods** The patient included in this study received composite build-ups for treatment of anterior attrition; this resulted in disclusion of all posterior teeth. Maxillary casts were produced prior to, and 45 days after treatment. The pre and post op upper models were 3D-digitized and superimposed using the palatal rugae for reference. A method for locating the centroid on the occlusal surface is described. This was tested for repeatability by locating the centroid of the UR6 ten times and comparing the 3D co-ordinates of the ten calculated centroids. The effect of any variation of centroid location on the calculated bodily tooth movement between pre and post op models was then investigated. The reason for choosing the UR6 was due to its large occlusal area and the fact that the palatal cusps were worn, making this the most likely tooth in this patient to give different centroids every time.

**Results** The average distance between the 10 centroids from the same tooth was 63µm and the standard deviation 35µm. Tooth movement was calculated for each of the 10 centroids from before to after treatment, the average clinical distance of eruption was 488µm and the standard deviation was 1.3µm.

**Conclusions** Our method identifies a clinically intuitive landmark (the centre of the occlusal surface) with a high degree of repeatability. This landmark is reliable, even on teeth with worn cusps. When used to measure bodily tooth movements, the effect of small errors in centroid location are clinically insignificant.

0202

**The Effects of Orthodontic Treatment on Pain, Oxidative Stress and Quality of Life**

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**Objectives** To investigate the effects of fixed orthodontic treatment on oxidative stress, quality of life, and subjective and objective components of pain. It was also aimed to evaluate the relationships between pain, oxidative stress, and quality of life in orthodontic patients.

**Methods** Thirty six patients were separated into two equal groups as the conventional group (group C) and the self-ligating group (group SL) in which conventional brackets and self-ligating brackets were used, respectively.

Prostaglandin F<sub>2α</sub> and 8-isoprostane levels were measured in saliva to evaluate pain and oxidative stress. Saliva samples were collected from each patient for five times at first 3 weeks of the orthodontic treatment. To assess pain perception and quality of life changes, 100mm- visual analogue scale (VAS) and verbal rating scale-4 (VRS-4) scales and Oral Health Impact Profile-14 (OHIP-14) survey were filled by patients, respectively.

**Results** There were significant increases in pain perception of two groups at T3 according to VAS and VRS-4.

However, the increase was more in the group SL than in the group C. Prostaglandin F<sub>2α</sub> levels increased in both groups but it was statistically significant only in group SL. 8-isoprostane levels didn't changed significantly in both groups.

**Conclusions** On the following 24 hours after force application, there were significant increases in the subjective and objective components of pain assessment and significant decreases in quality of life. No statistical changes in the 8-iso-PGF<sub>2α</sub> levels in both groups.

0203

**Maintaining the defense line: Recycling components of necrotized cells enables the action of antimicrobial peptides in the presence of microbial proteases**

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Bacterial species vary in their sensitivity to antimicrobial peptides. Many bacteria, including *Fusobacterium nucleatum*, are subjected to direct killing by the peptides. This is usually mediated by high affinity binding of the peptides such as LL-37 to the bacterial surface. In other bacteria such as *Treponema denticola*, the affinity of LL-37 was found to increase with increased expression level of outer surface virulence factors. Thus increased bacterial virulence, leads to increased susceptibility to LL-37. Binding of LL-37 to *Aggregatibacter actinomycetemcomitans* is efficient but LL-37 does not cause direct killing of the bacteria. Rather, LL-37 controls A.

*actinomycetemcomitans* by opsonising it and promoting its clearance and death by neutrophils and macrophages.

*Porphyromonas gingivalis* not only repels several antimicrobial peptides but also cleaves them to non-active derivatives in vitro. By doing so it hypothetically provides resistance for neighboring, otherwise susceptible species and abolishes non bactericidal, host defense actions of the peptides. In vivo however, protectorins such as actin released from necrotized cells protect LL-37 from cleavage by *P. gingivalis* and by other proteolytic bacteria. The protectorins enable the activity of LL-37 despite the presence of microbial proteases and by so enable spatio-temporal immunity in an attempt to arrest infection and control inflammation.

**0204**

**Regulation of Antimicrobial Peptides in the Gingival Epithelium**

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In the oral cavity, epithelial tissues function as the first line of defense protecting the host from the outside microbial environment. In this context, the gingival epithelial tissue is constantly exposed to a high variety of commensal and pathogenic microorganisms, but most individuals maintain healthy homeostasis. The gingival epithelium protects the host by not only providing a rigid physical barrier, but also by synthesis of innate immune defense molecules in the form of antimicrobial peptides (AMPs) such as e.g. human beta-defensins (hBDs), CC-chemokine ligand 20 (CCL20), and psoriasin (ps/S100A7). In addition to direct antimicrobial effects against bacteria, fungi, and viruses, AMPs also exhibit mediator-like activity linking innate and adaptive immune processes. AMPs are so-called “endogenous antibiotics” that have co-evolved with the bacterial flora, and bacteria have not developed significant peptide resistance. Due to this specific aspect of AMPs, those peptides may be promising agents for new preventive and/or therapeutic strategies in the treatment of inflammatory diseases such as periodontitis. This lecture will focus on regulation and expression of AMPs in gingival epithelial cells and fibroblasts in vivo as well as in vitro, and the question how cells respond to commensal and pathogenic oral bacteria, bacterial virulence factors, and intrinsic mediators will be addressed. Additionally, the involvement of cell surface receptors (pattern recognition receptors: toll-like receptors, proteinase-activated receptor-2) as well as intracellular signaling pathways during regulation of AMPs will be discussed.

**0205**

**Gingival Defensins in Health and Disease**

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Gingival epithelium secrete human beta-defensin (hBD)-1 constitutively, while infection and inflammation influence the secretions of hBD-2 and hBD-3, and human neutrophilic alpha-defensins. It is generally expected that tissue and oral fluid (gingival crevicular fluid, saliva) levels of gingival defensins positively correlate with the progression of periodontal diseases, however, studies demonstrate conflicting results. Analyses of gingival biopsies indicate lower levels of mRNAs of hBD-1, hBD-2, and hBD-3 in inflamed gingival tissues than in healthy ones. Moreover, protein levels of gingival defensins were found at slightly higher or equal, or in some cases lower, in periodontitis subjects than in their periodontally healthy counterparts. Up today, these controversies in different study findings were explained by differences in methodologies and characteristics of study populations, however, no clear answer has been given. In this presentation, the aim will be to 1) give current knowledge on the relationship between levels of gingival defensins and periodontal disease status, 2) discuss hypothesis that can explain the controversies in literature, and 3) present our recent findings on the effects of systemic conditions and diseases on gingival defensins.

0206

### **The effect of contamination on the Calcium silicate-based endodontic materials**

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In many of the challenging endodontic treatment modalities, a calcium silicate-based material is placed in contact with connective tissues to conduct hard tissue formation. Such material should fulfill a series of criteria. First of all it must be biocompatible and seal the cavity against the bacterial leakage. In addition, since control of the wetness of the cavity is not always feasible, the material should not be sensitive to the moisture. The material should also be unaffected by blood contamination. The hydration state of MTA specimens partially mixed with blood was more complete than those mixed entirely with blood and less than specimens that were hydrated only with water. At the microstructure level, lack of formation of the crystalline calcium hydroxide in the early stage of the hydration process and the absent of acicular crystals, characteristic of ettringite crystals, in blood-contaminated specimens was a common finding. This can explain the reduction in compressive strength and surface microhardness. The further blood becomes incorporated into MTA, the more the compressive strength, surface microhardness, push-out force of the material are reduced. In addition, its porosity is increased. Therefore, in clinical situations in which blood becomes incorporated into MTA, its physical properties are likely to be compromised. Therefore, it might be suggested that when using MTA, attempts should be made to control bleeding. When only the surface of MTA is exposed to blood, its physical properties may improve over the time. However, when it is partially or solely mixed with blood it cannot hydrate properly and its physical properties were compromised substantially. In this presentation the characteristic of the first launched calcium silicate-based endodontic material, mineral trioxide aggregate (MTA), will be listed and the advantages and disadvantages of it will also be discussed. Then, certain physical, chemical and biological properties of some recently launched MTA-like materials such as Bioaggregate, EndoSequence, MTA angelus, Biodentine, CEM cement will be compared with ProRoot MTA. The effect of various clinical situation on certain calcium silicate-based endodontic material will also be discussed.

0207

### **Parameters affecting effective curing depth of bulk-fill composites: correlative literature and in-vitro research**

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**Objectives** To identify parameters that affect effective curing depth of bulk-fill composites based on a systematic literature review in combination with a laboratory study.

**Methods** From a PubMed database search, 20 manuscripts assessing effective curing depth (ECD) of bulk-fill composites were identified. All data were extracted along with relevant parameters regarding curing and other analytic conditions. A linear mixed effects statistical model was constructed to analyze the effective curing depth in function of these parameters. For the laboratory investigation, composite blocks (10-mm deep) of the in literature most frequently tested bulk-fill composite (SDR, Dentsply) were made using different mould materials (aluminum, PMMA, tooth tissue) with diameters ranging from 2 to 8 mm and curing conditions at different radiant exposures (0.85 to 22.4 J/cm<sup>2</sup>, measured by MARC, BlueLight Analytics). After cross-sectioning at the specimen middle, the ECD was measured centrally as well as peripherally using micro-Raman spectroscopy ( $\mu$ Raman, Senterra, Bruker). **Results** Effective curing depth reported in literature for bulk-fill composites ranges from 0.2 to 9.45 mm. Parameters that affected the effective curing depth in literature were: 1) Radiant exposure: limiting the output power or curing time decreased the ECD with 0.52 mm per Log10 (energy in Joule); 2) Transparency of the mould material: using (semi-)transparent moulds, ECD increased about 1 mm in comparison to metal moulds; 3) Analysis position: at the specimen periphery, the ECD was about 0.4 mm lower. These parameters and mutual interactions were more accurately determined in the  $\mu$ Raman study, revealing the following results: 1) The ECD increased with the Log10 of the energy imposed (from 2.4 to 8.75 mm for 0.85 and 22.4 J/cm<sup>2</sup>, respectively). 2) While effective cure to the full depth of 10 mm was obtained with all transparent moulds, ECD was reduced with metal moulds, depending on the specimen diameter (6.1, 7.0, 8.1, 9.1, 9.6, 9.9 mm for 2-, 3-, 4-, 5-, 6- and 8-mm mould diameters, respectively). **Conclusions** Reported ECD of bulk-fill composites do vary considerably in literature, but should be explained by differences in study set-up. Especially the use of small-diameter opaque moulds should be avoided.

0208

### THE EFFECT OF THE CURING DISTANCE ON DEGREE OF CONVERSION OF BULK-FILL COMPOSITE RESINS

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**Objectives** The aim of this study was to evaluate the DC kinetics of bulk-fill composites with different chemical composition by fourier transform infrared spectroscopy (FTIR) technique.

**Methods** A total of 120 samples were prepared with four different composite resins in black cylindrical plastic molds. The main composite groups were, Filtek Bulk Fill Flow (3M ESPE), Compcore (Premier Dental), X-tra base (Voco), Sure Fil SDR (Dentsply). The composites for each groups were cured from 0 mm, 4 mm and 8 mm distance by mylar strip on the top of the mold. After 24 hours of incubation, each sample was divided horizontally at 2 mm intervals using a diamond saw. Then for evaluation of degree of conversion, absorbance peaks were recorded using a Fourier Transform Infrared Spectrophotometer (FTIR). Statistical analysis was performed using ANOVA and post-hoc comparisons were made using SNK test at 5% significance level.

**Results** There were significant differences founded between groups for degree of conversion. Compcore and SDR showed better DC than Filtek Bulk-Fill and X-tra base ( $p < 0.05$ ). Additionally, the LCU tip to composite distance effects the DC. The 0 mm showed higher DC than 8 mm ( $p < 0.05$ ). However no statistical differences were found among 0 mm and 4 mm; and among 4 and 8 mm distance. And the upper part of bulk fill resins showed better DC than lower part ( $p < 0.05$ ).

**Conclusions** The DC of bulk fill resins is affected by the distance of light source between restorative materials. The DC of resins was higher at upper side even cured from 8 mm.

0209

### Effects of Different Light Sources and Light Curing Techniques on Microhardness Values of Bulk Fill Resin Composites

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**Objectives** This study aimed to investigate the effects of different light sources and curing techniques on polymerization depths of bulk fill composite resins by using microhardness measurement.

**Methods** Two bulk fill (Tetric Evoceram, Sonic Fill) and one conventional (Z250) RBCs were analysed. 105 disk shaped specimens were prepared by using stainless steel mold. 15 groups were assigned for this study that polymerized with QTH and LED by ramped, pulse and std modes/conditions. Z250 was used as a control. Specimens were stored in distilled water at 37 °C for 24 h before measurement. The Vickers hardness (VK) of the top/bottom surfaces of the specimens were determined.

**Results** The statistical analysis was handled with the SPSS 22 software (Statistical Package for Social Sciences). Evaluation of evidence was done using One-Way Anova, Tukey's HSD ve Student's-t tests. Statistically significant difference was not showed between the effectiveness of LED and QTH light curing units above hardness values of the composites. Conventional microhybrid resin composite Z250 showed higher microhardness values than Sonic Fill ( $p:0.002$ ,  $p < 0.01$ ) and TEC ( $p:0.001$ ,  $p < 0.05$ ) and SF showed higher microhardness values than TEC ( $p:0.001$ ,  $p < 0.01$ ). Statistically significant difference was not showed regarding the light curing modes/conditions both LED and QTH light curing units above bulk fill composites. Whereas Z250 higher microhardness values were observed at bottom surfaces in respect of top surfaces associated with the ramp mode both LED ( $p:0.030$ ,  $p < 0.05$ , LED std: 68.74, ramp:61.92) and QTH ( $p < 0.01$ , QTH std:69.22, ramp:47.71) light curing units. The bottom-to-top HV ratio was low than 80 % in all materials (Z250: %76.84, TEC: %46.06, SF: %65.31).

**Conclusions** In the light of the present study results discrepancies in the organic matrix types, inorganic structures and photoinitiator types of the composites, light sources and light curing techniques used for polymerization effected microhardness values.



0210

### **Comparison of Polymerization Shrinkage and Microleakage of Bulk-Fill and Conventional Composites**

Saruhanoglu, G., Dikici, B., Soyman, M., Can Say, E.

Yeditepe University Dental Faculty

**Objectives** The purpose of this in vitro study was to compare the volumetric polymerization shrinkage of three different type of bulk-fill composites (Sonic Bulk, (SB); Tetric EvoCeram Bulk-Fill, (TB); X-tra fil, (X-F)), and two conventional layering composites (Charisma Diamond, (CD); Filtek Z 250, (Z250)) and to evaluate the microleakage in Slot Class II cavities.

**Methods** 40 non-carious third molar teeth were divided into 5 groups (n=8) and standardized Slot Class II cavities (n:16) were prepared both on mesial and distal sides of each teeth. For all the cavities, Clearfil SE Bond adhesive was applied with a selective enamel etching approach and then they were restored with bulk-fill and conventional composites according to the manufacturer's instructions. The specimens were finished and polished after 24 hours storage in distilled water at 37°C. Following thermocycling regimen of 5000 cycles between 5-55°C, the specimens were immersed in 0.5% basic fuchsin for 24 hours, sectioned and examined for microleakage using a stereomicroscope (Leica). The extend of the gingival marginal microleakage was recorded. The volumetric polymerization shrinkage (VS) of the composites was measured using a video imaging device (AcuVol, Bisco Inc; n:10). Data were analyzed using Kruskal-Wallis and MannWhitney U-tests ( $p<0.05$ ).

**Results** There are statistically significant differences between the composites for the tested parameters ( $p<0.05$ ). Z250 presented the least gingival marginal microleakage than all the other composites ( $p<0.05$ ) while the difference between TB, SF, X-F and CD were not significant ( $p>0.05$ ). Regarding VS, SF showed significantly the lowest, while X-F presented the highest ( $p<0.05$ ), whereas no significant differences between Z250, TF and CD were evaluated ( $p>0.05$ ).

**Conclusions** The volumetric polymerization shrinkage does not depend on the type (bulk-fill vs conventional) of the composite. Different type of bulk-fill composites may result in similar gingival marginal microleakage which is similar or worse than conventional layering composites.

0211

### **Polymerization and Mechanical Properties of Contemporary Composites: LED or QTH?**

Dikici, B., Saruhanoglu, G., Can Say, E.

Yeditepe University Faculty of Dentistry

**Objectives** The aim of this study was to compare the depth of cure (DOC), Vickers hardness (VH), flexural strength (FS) and elastic modulus ( $E_{mod}$ ) of bulk-fill, low-stress and conventional layering composites cured with LED or QTH light-curing units (LCU).

**Methods** Four high-viscosity bulk-fill composites; Sonic-Fill (SF), Tetric N Ceram Bulk Fill (TBF), Filtek Bulk Fill (FB), everX Posterior (eXP), two low-viscosity bulk-fill composites; Venus Bulk Fill (VB), Surefil SDR (SDR) and two low-stress composites; Kalore (K), Charisma Diamond (CD) and one conventional composite Filtek Z250 (Z250) were tested. All the specimens were prepared according to ISO 4049 for the tested parameters (n:20 from each composite for F-E and HV; n:10 for DOC), polymerized according to the manufacturer's instructions with LED (Demi Ultra) or QTH (Optilux 501) and stored in distilled water at 37 °C for 24 h before the measurements. HV was evaluated on the top, at 2mm and 4mm of each specimen (Buehler) while DOC was calculated as the 80 % hardness drop-off by using a HV profile, starting from the surface. FS and  $E_{mod}$  were determined by three point bending test (Instron). Data were analyzed by two-way ANOVA and post hoc Tukey's tests and one-way ANOVA and Student t tests ( $p<0.05$ ).

**Results** The tested composites cured with LED showed statistically significant higher FS and  $E_{mod}$  than cured with QTH ( $p<0.05$ ). ExP presented the highest FS and  $E_{mod}$  while VB presented the lowest than all the other composites ( $p<0.05$ ). SF and CD showed significantly the highest HV on top, SF, CD and Z250 at 2mm and SF at 4mm, while VB recorded the lowest for both LED and QTH on top, at 2mm and at 4mm . DOC of all the tested bulk-fill materials exceeded 4mm with LED and QTH LCU.

**Conclusions** LED curing was found to be more successful than QTH with respect to the flexural strength and elastic modulus properties. Mechanical properties of high-viscosity bulk-fill composites cured with LED or QTH LCU were similar to or slightly better than those of low-stress and conventional layering composites.

0212

**Clinical and Radiographical Evaluation of Hyaluronic acid and Bovine Derived Xenograft Combination versus Bovine Derived Xenograft Alone in Intrabony Defects**

Otçuoğlu, D., Yilmaz, S., Cakar, G., Dirikan Ipci, S.

Yeditepe University

**Objectives** The purpose of this randomized, parallel and controlled clinical trial was to compare the clinical and radiographical effectiveness of a new biomaterial including hyaluronic acid (HA) and bovine derived xenograft (BDX) combination versus of a bovine derived xenograft (BDX) application in the treatment of periodontal intrabony defects.

**Methods** Twenty advanced chronic periodontitis patients who had intrabony component of  $\geq 3$  mm and radiographical intrabony defects with an associated probing depth (PD) of  $\geq 5$  mm were included. 54 intrabony defects were surgically treated with the HA + BDX (1st group) and 55 intrabony defects were treated with BDX alone (2nd group). Plaque and sulcus bleeding indices, PD, marginal recession, relative attachment and bone levels and radiographic bone level were recorded at baseline and 12 months after surgery.

**Results** At 12 months, intragroup comparisons for all evaluated clinical and radiographical parameters revealed statistically significant differences compared to baseline ( $p < 0.05$ ). Considering the deepest site of the defects, group 1 and 2 showed a mean PD reduction of  $3.38 \pm 1.29$  mm and  $2.99 \pm 0.75$  mm, attachment gain of  $2.56 \pm 1.26$  mm and  $2.33 \pm 0.57$  mm, recession of  $0.79 \pm 0.88$  mm and  $0.66 \pm 0.56$  mm, clinical bone gain of  $2.8 \pm 1.45$  mm and  $2.09 \pm 0.65$  mm and radiographic bone gain of  $2.38 \pm 1.34$  mm and  $1.83 \pm 0.95$  mm, respectively. Intergroup comparisons for all parameters were found to be insignificant ( $p > 0.05$ ).

**Conclusions** Within the limits of this study, it can be concluded that both HA+BDX and BDX treatments demonstrated similar clinical improvements in intrabony periodontal defects.

0213

**Effect of Platelet Rich Fibrin on the Treatment of Gingival Recessions**

Kuka, S., Dirikan Ipci, S., Cakar, G., Yilmaz, S.

Yeditepe University

**Objectives** The objective of this randomized, parallel and controlled study was to assess the clinical effectiveness of platelet rich fibrin (PRF) in combination with coronally advanced flap (CAF) on defect coverage, esthetics and patient satisfaction compared to CAF alone for the treatment of Miller Class I multiple buccal recessions.

**Methods** A total of 20 patients (10 females and 10 males) with 49 Miller Class I multiple recessions  $\geq 3$  mm were included and divided into two groups, CAF+PRF and CAF. At baseline and 6 months after the surgery, plaque and gingival indices, probing depth, clinical attachment level, recession height (RH), keratinized tissue height, gingival thickness (GT), and mean and complete defect coverage were evaluated. Patient satisfaction, root coverage esthetic score were also assessed.

**Results** Baseline RH in CAF+PRF and CAF alone groups was  $3.36 \pm 0.34$  mm and  $3.2 \pm 0.26$  mm, respectively. Intragroup comparisons revealed statistically significant differences at 6 months compared to baseline data for all parameters ( $p < 0.05$ ). GT increased from  $0.78 \pm 0.06$  mm to  $1.31 \pm 0.07$  mm in CAF+PRF group, and from  $0.73 \pm 0.07$  mm to  $0.8 \pm 0.08$  mm in CAF alone group. Mean defect coverage was 74.63 % (RH reduction:  $2.51 \pm 0.33$  mm) in CAF + PRF group, and 79.02 % (RH reduction:  $2.5 \pm 0.53$  mm) in CAF alone group with no statistically significant difference between the groups.

**Conclusions** Both techniques were successful in the treatment of Miller Class I gingival recessions. Tissue thickness significantly increased with the use of PRF graft in CAF+PRF group.

0214

**Tree-year clinical results for treatment of multiple gingival recession defects with Titanium Prepared Platelet Rich Fibrin: a case series.**

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**Objectives** In our previous studies, we developed a platelet rich product called titanium prepared platelet-rich fibrin (T-PRF). T-PRF, is based on the hypothesis that titanium is more effective at activating platelets than the silica activators used with glass tubes in platelet-rich fibrin. We established that the fibrin carpet formed with titanium had a firmer network structure, and longer resorption time in the tissue than the fibrin carpet formed with glass. There has been no study to date evaluating the long-term predictability of T-PRF membrane for root coverage. This study evaluated the long-term effectiveness of a T-PRF membrane combined with a coronally repositioned flap surgery in a treatment of deep gingival recession defects.

**Methods** Four subjects with 18 Miller Class I or II defects were selected. The defects were  $\geq 3.0$  mm deep and were treated with a coronally positioned flap associated with a T-PRF membrane. Probing depth (PD), clinical attachment level (CAL), gingival recession depth (GRD), and keratinized tissue width (KT) were assessed at baseline, 1 month, 6 months, 1 year, 2 years, and 3 years after the surgery.

**Results** The mean initial gingival recessions were 4.81 mm. Three years after surgery mean root coverage was 95.4 %.

**Conclusions** Within the limits of this study, the long-term results demonstrated that T-PRF membrane combined with a coronally repositioned flap procedure is safe and effective in a treatment of class I and II Miller gingival recessions without a requirement for additional surgery.

0215

**Investigation On The Microcirculation Of The Modified Coronally Advanced Tunnel Technique After Root Coverage Procedure**

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**Objectives** The application of autologous connective tissue graft (CTG) in combination with the modified coronally advanced tunnel technique (MCAT) is a standard method to treat multiple gingival recessions. However, the graft harvesting may increase patient morbidity and the duration of surgery as compared to surgical techniques using xenogenic matrices. The widely used xenogenic collagen matrix Mucograft has optimal tissue integration without inflammatory adverse reactions, but delays the revascularization of the wound bed according to a recent in vitro study. The aim of our study was to compare the effect of Mucograft and CTG on the microcirculation of MCAT.

**Methods** In an exploratory study 8 patients (4 females and 4 males) received either Mucograft or CTG from the palate combined with MCAT. Clinical outcomes were evaluated after 6 months. Postoperative gingival microcirculation was followed up throughout 6 months by a Perimed Laser Speckle Contrast Analyzer. Wound fluid secretion was measured by Periotron 8000.

**Results** Reduction of recession depth and width were comparable in the two groups, but the gain in keratinized tissue width at Mucograft treated sites was significantly less than in CTG. Interestingly, Mucograft treated sites showed significantly higher blood flow postoperatively, especially in male subjects. Overall, males had significantly more increase in blood flow. There were no differences in wound fluid secretion between graft types. Females had higher and more prolonged wound fluid secretion.

**Conclusions** The microcirculation of the MCAT recovers quickly within 10 days. The recovery of graft bed circulation was not restrained by the application of Mucograft. Gender may have an effect on blood flow and inflammation following root coverage procedures, but this needs to be confirmed in further experiments.

0216

**A Comparative Clinical Evaluation of Titanium Prepared Platelet Rich Fibrin and Subepithelial Connective Tissue Graft for Management of Multiple Gingival Recession Defects**

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<sup>1</sup>Karadeniz Technical University, <sup>2</sup>Gülhane Military Medicine Academy

**Objectives** A novel platelet-rich product, titanium-prepared platelet-rich fibrin (T-PRF), is based on the hypothesis that titanium is more effective at activating platelets than the silica activators used with glass tubes in platelet-rich fibrin. In our previous studies, we established that the fibrin carpet formed with titanium had a firmer network structure, and longer resorption time in the tissue than the fibrin carpet formed with glass. There has been no study to date comparing the effectiveness and predictability of T-PRF with that of the gold standard subepithelial connective tissue graft (CTG) for root coverage. The purpose of this randomized clinical trial was to compare these different autogenous graft materials (T-PRF& CTG) for the management of Miller Class I/II multiple adjacent gingival recessions.

**Methods** 34 patients were referred to our clinic with a total of 104 Miller Class I/II gingival recessions represented that exposed root surfaces showed abrasion defects, indicating toothbrushing trauma as the causative factor. The brushing techniques were improved and recessions were randomly treated with T-PRF (52 teeth) or CTG (52 teeth) and modified tunnel technique. The following clinical measurements were taken before the surgery and at 1 month, 3 months and 6 months follow-up examination: probing depth (PD), clinical attachment level (CAL), amount of keratinized tissue (KT), and recession depth (RD). Also Visual Analog Scale, healing index were evaluated.

**Results** After 6 months, mean root coverage was 91.08% and 88.66% in the T-PRF and CTG groups, respectively. Furthermore, the mean amount of KT increased by 1.33 mm and 0.95 mm in the T-PRF and CTG groups, respectively.

**Conclusions** Within the limits of this study, the results demonstrated that T-PRF membrane is safe and effective in a treatment of Miller Class I/II gingival recession defects. T-PRF may present an alternative to CTG without a requirement for additional surgery.

0217

**DIMENSIONAL CHANGES IN FREE GINGIVAL GRAFTS WITH LOW LEVEL LASER THERAPY: A PRELIMINARY STUDY**

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ABANT IZZET BAYSAL UNIVERSITY

**Objectives** Low level laser therapy (LLLT) is widely used during the post-operative period to accelerate the healing process. It promotes beneficial biological action on neovascularization with anti-inflammatory and analgesic effects. The aim of this clinical study was to compare the action of a low-intensity diode laser on the healing process by assessing free gingival graft (FGG) dimensional changes in individuals undergoing free gingival grafts.

**Methods** Four systemically healthy and non-smoker patients were referred to Abant İzzet Baysal University, Faculty of Dentistry, Department of Periodontology. Graft was harvested from palate and periodontal dressing wasn't used. After surgery patient received LLLT using a 820nm diode laser, with output power of 1 W. immediately after surgery, on the first day, on the 7th day and lastly on the 14th day. Probing depth and FGG dimensions (horizontal-superior (HS), horizontal-inferior (HI), and vertical (V)) were assessed by using digital caliper at the same reference point and recorded before surgery, 1 and 3 months postoperatively.

**Results** Although in this study we didn't use periodontal dressing, healing was uneventful and patients' discomfort was minimum. Free gingival graft with assist of low level laser therapy show promising result for all following intervals. Graft dimensions were 10.00mm, 11.75mm and 6.25mm before the surgery; 8.5mm, 12.37mm and 5.87mm within the first month; 8.33mm, 9.66mm and 5.33mm within first three months for HS, HI and V; respectively. Normality of distribution was tested with the Shapiro-Wilk procedure. Kruskal-Wallis was used for the intergroup comparisons. There were no significant differences between the time interval.

**Conclusions** The results showed that LLLT was an effective adjunctive treatment in promoting revascularization during early healing of FGG. In addition these results may support the idea of low-level laser therapy as a supportive therapy in patients receiving free gingival graft.

**0218**

**'Etch-and-rinse' versus 'self-etch', which is the best approach to durably bond to enamel and dentin?**

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KU Leuven (University of Leuven)

'Etch-and-rinse' versus 'self-etch', which is the best approach to durably bond to enamel and dentin?

Current dental adhesive technology follows either an 'etch-and-rinse' or a 'self-etch' approach. Etching enamel with phosphoric acid following the 'etch-and-rinse' procedure is sure to result in a durable bond. 'Self-etching' enamel is known to require at least some pre-bonding roughening by bur to ameliorate bonding performance. On dentin, phosphoric acid applied following an etch-and-rinse procedure effectively removes surface smear that otherwise may interfere with bonding, but also exposes collagen to several micrometers deep. The bond stability highly depends on how tight resin is able to envelop the exposed collagen in order to make the resultant thick hybrid layer resistant to hydrolytic and enzymatic degradation. The alternative 'self-etch' approach applied on dentin makes use of functional monomers that either result in a more significant demineralization effect requiring efficient resin infiltration in the few micrometer deep hybrid layer thereafter, or rely on chemical interaction with hydroxyapatite that remained within the submicron hybrid layer. The objective of this presentation is to weigh the 'etch-and-rinse' approach against the 'self-etch' approach. The effectiveness of contemporary adhesives measured in the laboratory will be correlated with clinical data.

**0219**

**Equia Fil - The clinical performance over four year in a Dental Practice-Based Research Network**

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Background: The aim of this prospective clinical trial was to evaluate the clinical performance of Equia fil® with a nano-filled resin coating (Equia) and a conventional Fuji IX GP fast® with LC coating (GP fast) with dental practitioners in the field (NBRCT). Material and Methods: With both filling systems either Equia (n=515) or GP fast (n=486) permanent teeth in occlusal cavities (class I, II and class II MOD) were restored. Clinical, photographic and stone cast assessment according to FDI criteria were carried out at 1 year up to the 4 year interval done by external examiner. The change in clinical criteria over time was estimated with logistic mixed models, which use all available data, properly account for correlation between repeated measurements in dentists, patients, and in teeth, and appropriately handle missing data if the missing at random assumption is met. Results: In total 1001 fillings were placed by 111 dentists in 643 patients. The adjusted random slope models showed that Equia had an overall less odds in obtaining a score 5 (material needs replacement) in comparison to GP fast. For both materials, filling size and shape was the most important component which affected the clinical performance of the materials. When measuring the odds of obtaining a score 5 (material need replacement), odd ratios jumped to approximately 43 times for class respectively in comparison to class I fillings. Conclusion: Both materials showed similar good overall performance in class I cavities, however, when including both numbers from class I and II fillings, Equia Fil® showed better overall performance with fewer failures in all the followup intervals. Nonetheless, percentage of unsatisfactory to poor fillings according to FDI criteria was relatively high in class II fillings in both materials.

**0220**

**6 year clinical success of GI restorative comparing with composite resin in posterior teeth**

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GICs are clinically attractive dental materials and have certain unique properties that make them useful as restorative and adhesive materials. Since their introduction, many modifications of these materials have been performed over the years. Despite having advantages such as adhesion to moist tooth structure, anticariogenic properties due to the release of fluoride, thermal compatibility with tooth enamel, biocompatibility and low toxicity, GICs suffer from low fracture toughness and a higher rate of occlusal wear compared to other restorative materials, such as amalgam and composites. To overcome the disadvantages of classical GIC, a unique concept called EQUIA (GC Europe, Leuven, Belgium) was introduced in 2007 which tries to combine the main advantages (self-adhesion, bulk application and improved mechanical properties) of the highly viscous GIC (Equia Fil) with a nano-filled, light curing coating (Equia Coat) that provides protection, improve strength and surface hardness. So far, only results of very few clinical studies under university environment conditions have been published. In this presentation, the clinical effectiveness of this GIC restorative material on the treatment of permanent posterior teeth, compared with a microhybrid composite resin (Gradia Direct Posterior, GC, Tokyo, Japan) in 6 years period will be discussed.

**0221**

**Introducing the Glass Hybrid Technology**

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Dentists face a variety of clinical conditions, which oftentimes demand restorative treatment with specific requirements and difficulties. On the other hand, a range of restorative materials and their combinations are available, each coming with certain advantages and shortcomings, shaping their indications. With a growing political push towards mercury free environment, there is need for economical alternatives to amalgams. There is the demand for materials which are quick and easy to use, even in less-than-optimal environments. One material class which fulfilled some, but not all these demands in the past were glass ionomer cements. In recent years, these materials have advanced, with improved physical and aesthetic properties, increasing the potential spectrum of application. The latest advance in this evolution are Glass Hybrids, which are introduced in this presentation. The alterations in the material composition, properties and performance will be demonstrated. In vitro data supporting these materials compared with conventional glass ionomer cements as well as other materials will be presented and the demands dentists have towards a modern restorative material will be compared with the characteristics of glass hybrids. Clinical cases will be presented and current gaps in the knowledge towards these materials be described.

**0222**

**Oral biofilm models in vitro: more than a thickness**

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In vitro models of oral biofilm are indispensable for development of new preventive measures, including toothpaste and mouthrinse formulations or design of toothbrushes or other mechanical tools for biofilm removal. Biofilms can be grown in vitro under flow or static conditions, under nutrient limitation or in full medium, using single strains or combinations of strains. Advantages and disadvantages of different models are discussed. It is a crucial question, when in vitro biofilms are a sufficient mimic of our clinical biofilms. An answer to this question is often based on microbial composition, viability, numbers of CFUs or thickness. Yet, structure and matrix composition may differ widely across different biofilms, despite similarities in either of the above properties. It will be shown that structure and matrix composition are determinant factors in both chemical and mechanical biofilm control measures. Moreover, structure and biofilm composition can be reflected quantitatively in the visco-elasticity of a biofilm with as an additional advantage that measurement of biofilm visco-elasticity encompasses much larger biofilm areas than can be covered microscopically. Herewith, measurement of visco-elasticity is advocated for the description of a biofilm. In vitro growth biofilms according to different models will be compared with in vivo grown biofilms based on their visco-elasticity. It is concluded, that measurement of visco-elasticity is preferred for such comparisons above measurements of microbial composition, viability, numbers of CFUs or thickness.

**0223**

**Ecological perspectives on managing oral biofilms.**

Marsh, P.

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The mouth supports a diverse microbiota that grows on oral surfaces as structurally- and functionally-organised biofilms. The oral microbiota is natural and provides essential benefits to the well-being of the host, including immunological priming, down-regulation of excessive pro-inflammatory responses, exclusion of exogenous microbes, and regulation of gastrointestinal and cardiovascular systems. The prevailing physical, chemical and biological properties dictate the composition of the oral microbiota at each site. Once established, the composition of the microbiota remains stable over time. This stability can be perturbed by changes to the environment (examples include changes to the diet, saliva flow, integrity of the host defences, etc) which drive a shift in the microbiota, thereby increasing the risk of disease (dysbiosis). Oral health can be maintained by preventing these deleterious shifts in the microbiota, either by inhibiting certain organisms directly or by interfering with the environmental changes that drive these perturbations. A balance is needed, however, to control the oral microbiota at levels compatible with health, without killing/removing beneficial bacteria and losing the key benefits they provide. Many oral care products are formulated with antimicrobial agents to augment mechanical plaque control. Twice daily topical use of these oral care products with antimicrobial agents may help to achieve this balance because (a) their targets are multi-species biofilms, which display reduced susceptibility, and (b) their pharmacokinetic profiles result in their presence for longer periods at sub-lethal concentrations. At these levels they can inhibit traits implicated in disease (e.g. sugar transport/acid production; protease activity) and retard bacterial growth without eliminating beneficial species. In silico modelling studies support the concept that reducing the frequency of acid challenge and/or the terminal pH, or merely slowing the growth of bacteria will maintain beneficial bacteria under circumstances that might otherwise lead to overgrowth by putative pathogens (controlling without killing).

**0224**

**Towards understanding Oral Health**

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During the last century, dental research has focused on unraveling the mechanisms behind various oral pathologies, while oral health was typically described as the mere absence of oral diseases. The term ‘oral microbial homeostasis’ is used to describe the capacity of an oral ecosystem to maintain microbial community stability at health. However, the entire oral ecosystem itself is not stable: an individual undergoes multiple physiological changes throughout life when a person progresses through infancy, childhood, adolescence, adulthood and old age. Recent discussions on the definition of general health have led to the proposal that health is the ability of the individual to adapt to physiological changes, a condition described as allostasis. In the presentation the allostasis principle will be applied to the oral ecosystem and illustrated with clinical examples. The complexity of oral health and the mechanisms that prevent the ecosystem from collapsing during allostatic changes in the entire body, are far from being understood. To date individual components (e.g., hard tissues, microbiome, saliva, host response) have been investigated. By consolidating these and assessing their multidimensional interactions we should be able to reach a comprehensive understanding of the ecosystem. This in turn could serve to develop rational schemes for maintaining health.

**0225**

**Whole Mouth Health**

Cummins, D.

Colgate - Palmolive Technology Center

Decades of clinical research have proven that meticulous plaque control can prevent dental caries and periodontal disease, and maintain good oral health. Yet, global disease patterns demonstrate the importance of supplementing mechanical oral hygiene, as it alone is not fully effective in most individuals. Recent new science underpinning the role of the natural oral microbiota in oral health and disease has outlined important concepts that are highly relevant to safe and effective plaque control. Specifically, the ideas that the normal oral flora is diverse, is present largely as biofilm on soft and hard tissues, is stable over time (homeostasis/allostasis), but can be perturbed by changes in an individual's physiology or behavior, and provides essential benefits to the individual's wellbeing, provide great insight. A rational 'state-of-the-art' approach to effective plaque control and the maintenance of good oral health is to supplement mechanical plaque control with the use of oral care products which are able to target the oral microflora to reduce plaque and the risk of dental disease, whilst concurrently creating and supporting the beneficial functions of a normal oral microflora consistent with health. Thereby, a small behavioral change – to the use of proven antimicrobial products – can offer an individual a logical approach to help protect (insure) against potential detrimental physiological changes in the future. The concept of 'Whole Mouth Protection' and 'Whole Mouth Health' will be introduced, and the role of the soft tissues in helping control plaque formation on the teeth will be discussed. The concept will be illustrated by demonstrating 1) the superior antibacterial protection of the teeth and soft tissues that results from brushing with a proven antibacterial toothpaste which delivers sub-clinical levels of triclosan for 12 hours between brushing occasions, and 2) the consequent effects of that superior antibacterial protection on plaque and related outcomes.

**0226**

**Using a Chewing Simulator to Test Layered Ceramic Crowns for Fatigue**

Heintze, S. D., Monreal, D.

Ivoclar Vivadent

**Objectives** To test whether the Willytec chewing simulator is a suitable tool to evaluate layered ceramic crowns for fatigue resistance.

**Methods** Four metal ceramic materials were tested on lower first molar crowns: GC Initial, Creation (Willy Geller), IPS InLine (Ivoclar Vivadent) and the new low-fusion IPS Style (Ivoclar Vivadent). The ceramic material was manually layered on frames made of the nickel-chromium alloy 4all (Ivoclar Vivadent) by using a silicone mold. The crowns were adhesively luted to PMMA dies. Dynamic loading was carried out with a Willytec simulator (SD Mechatronik) using additional bars with weights. A steel antagonist (Ø 4mm) with 40mm/s downward speed hit the disto-buccal cusp of the crown with minimal impulse while sliding for a distance of 0.7mm. The starting load was 250N. The forces at each load level had been verified with a 3D force sensor (Kistler). Four crowns per group and load were submitted to four decreasing load levels for 200,000 cycles at 0.8 Hz and simultaneous thermocycling (5°C/55°C) until all four crowns no longer showed chippings. The fatigue resistance was calculated by linear regression analysis (SPSS) relating each failure per load to the log-transformed number of cycles.

**Results** At 250N all materials showed chippings within the ceramic or down to the metal frame, while at lower loads there were differences. The fatigue resistance was as follows: IPS InLine 195N, IPS Style 180N, Creation 139N, GC Initial 115N. The F-test with post-hoc Bonferroni correction revealed a statistically significant difference between IPS InLine/IPS Style and Creation/GC Initial ( $p < 0.001$ ) while the two former and two latter materials did not significantly differ from each other ( $p > 0.05$ ).

**Conclusions** The Willytec simulator is an adequate tool to test layered ceramic crowns for fatigue resistance. The low-fusing IPS Style metal ceramic had a significantly higher fatigue resistance than Creation and GC Initial.



0227

### **Abrasion behavior of different ceramic crown materials and antagonizing human enamel**

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<sup>1</sup>School of Dentistry, <sup>2</sup>School of Dentistry

**Objectives** Evaluation of abrasive behavior of various CAD/CAM fabricated restoration materials in combination with human molars.

**Methods** 30 extracted human molars were prepared for full CAD/CAM crowns. Crowns were fabricated from the following materials: resin nano ceramics (Lava Ultimate) (n=10), hybrid ceramics (Vita Enamic) (n=10), and lithium silicate ceramics reinforced with zirconium dioxide (Vita Suprinity) (n=10), according to the pertinent antagonist (cavity-free human molar). The crown/molar pairs were submitted to a chewing simulation (1.200.000 cycles, 50N). 3D data sets of the complete occlusal surface, the most stressed cusp of crown and respective antagonist were generated via Laser scanner, matched prior to and after the chewing simulation and analyzed (Alicona measuring system). The Mann-Whitney U test ( $p < 0.05$ ) was used for statistical data analysis.

**Results** Relative to the complete occlusal crown surface, the highest median value of medium abrasion was found for Lava Ultimate with 21.1  $\mu\text{m}$  (interquartile range 18.6-24.5 $\mu\text{m}$ ). Vita Enamic and Vita Suprinity reached median values of 9.3 $\mu\text{m}$  (8.9-10.4 $\mu\text{m}$ ) and 14.1 $\mu\text{m}$  (11.1-18.4 $\mu\text{m}$ ) respectively. Statistically significant differences were found between all materials ( $p < 0.05$ ). The median value of the medium abrasion for the antagonists in conjunction with Lava Ultimate was 10.4 $\mu\text{m}$  (9.5-12.4 $\mu\text{m}$ ), with Vita Enamic was 12.9 $\mu\text{m}$  (11.2-16.5 $\mu\text{m}$ ) and with Vita Suprinity reached 14.5 $\mu\text{m}$  (9.7-20.8 $\mu\text{m}$ ). A statistically significant difference was found in the comparison of antagonists in combination with Lava Ultimate and Vita Enamic ( $p = 0.019$ ). Relative to the most stressed cusp of the crown, the highest median value of medium abrasion for the antagonists was found in combination with Lava Ultimate (59.5 $\mu\text{m}$ ; 43.2-73.1 $\mu\text{m}$ ), the lowest - with Lava Ultimate (12.0 $\mu\text{m}$ ; 10.5-13.9 $\mu\text{m}$ ).

**Conclusions** In the case of Vita Enamic and Vita Suprinity, the loss of substance on crowns and antagonists were found to be on a comparable level. For Lava Ultimate, the abrasion of crowns was higher compared to the antagonists.

0228

### **Staining Resistance of Different Non-Fireable CAD/CAM Resin-Ceramics**

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**Objectives** Ceramic materials offer superior aesthetic properties in dentistry. Novel CAD/CAM resin-ceramic materials were introduced to achieve more elastic, less rigid, and less fragile restorations. However, the resin content makes the glazing procedure impossible. The aims of this study were to evaluate the staining resistance of CAD/CAM resin-ceramics polished with different techniques and to determine the effectiveness of polishing techniques in resin-ceramics comparing with a glazed glass-ceramic.

**Methods** Four different CAD/CAM ceramics: (FC) feldspathic ceramic (CEREC Blocs, SIRONA), (RNC) resin nano ceramic (Lava Ultimate, 3M ESPE), (HCe and HCc) two different hybrid ceramics (Enamic, VITA and CeraSmart, GC); and (CR) light cure composite resin (Clearfil Majesty Esthetic, Kuraray) were used. FC samples were only glazed (gl). Other restoratives were divided into four groups according to polishing technique: (c) non-polished control group, (bb) polished with light cure liquid polish (Biscover LV BISCO), (ed) polished with ceramic polishing kit (Diapol, EVE), and (kc) polished with composite polishing kit (Clearfil Twist Dia, Kuraray). Glazed FC samples and polished samples were further divided into four subgroups and immersed into different solutions: Distilled water, tea, coffee, fermented black carrot juice. Eight samples (dimensions: 8×8×1 mm) for each subgroup and a total of 544 samples were prepared. According to CIELab system, four color measurements were made using a digital spectrophotometer (SpectroShade Micro, MHT): before immersion, immersion after a day, a week and a month. Data were analyzed with repeated measures of ANOVA ( $\alpha = 0.05$ ).

**Results** The best staining resistance was found in gl samples. There was no difference among gl and kc and ed ( $p > 0.05$ ). Staining resistance of gl was significantly higher than bb ( $p < 0.05$ ). Staining resistance of HCe and HCc were significantly higher than RNC and CR ( $p < 0.05$ ).

**Conclusions** Ceramic and composite polishing kits, used in this study, can be applied on resin-ceramics to obtain similar results with glazed glass-ceramic.

0229

### **Effect of Different Surface Treatments on the Surface Roughness of Ceramic Resin Composite CAD/CAM Blocks**

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Kirikkale University

**Objectives** The aim of this study was to evaluate the effect of different surface treatments on the surface roughness of ceramic resin composite blocks.

**Methods** 240 square shaped (5 x 5 x 2 mm) ceramic resin composite specimens were prepared by using Lava Ultimate and Vita Enamic. After specimens divided into 4 subgroups (n=30) randomly, the following surface treatments was performed respectively: Group C—control (no treatment), Group SB—sandblasted (2 bar, 5 sn, 50 µm aluminium oxide (Al<sub>2</sub>O<sub>3</sub>) particles), Group HFA—hydrofluoric acid etched (60 sn, 5% hydrofluoric acid), Group FSL—femtosecond laser irradiated (800 nm, 0.3 mJ, 1 kHz, 300 mW, 90 fs, distance: 11 cm). After surface treatments, surface roughness were measured with profilometry. The average roughness values were calculated by obtaining Ra (µm) values from three different regions of each specimen surface. One specimen which closest to the average roughness value from each group were analysed in scanning electron microscope (x1000), after average surface roughness were determined. The data was statistically evaluated by using One-Way ANOVA and post hoc Dunnett's test.

**Results** All surface treatments created rougher surfaces than control group of both materials (p=0,00). Laser irradiation obtained the roughest surfaces also similar values (p=0.26) on both material. Moreover, acid etching created significantly rougher surfaces on Vita Enamic (p=0,00), while sandblasting created rougher surfaces on Lava Ultimate (p=0,00).

**Conclusions** Sandblasting, acid etching and laser irradiation are effective surface treatments for roughening surfaces of ceramic resin composite. However, the contribution of these surface treatments especially laser irradiation to bond strength must be evaluated with further studies.

0230

### **Bond strength of porcelain laminate veneers to tooth surfaces prepared with femtosecond and Er:YAG laser**

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**Objectives** Recently Femtosecond laser is very popular by being an innovative method in the ablation of dental ceramics. This laser system has been thought in the use of the surface preparation of dental tissues with the growing technology.

This in vitro study evaluated the microtensile bond strength of porcelain laminate veneers (IPS Empress II) to tooth surfaces after irradiated with Femtosecond and Er:YAG laser.

**Methods** Thirty three extracted caries-and restoration-free human maxillary central incisors were used. The teeth were sectioned 2 mm below the cemento-enamel junction. The labial surfaces were prepared with 1 mm reduction to receive porcelain veneers. The teeth were randomly divided into 3 groups of 11 specimens. Twenty two specimens received one of the following surface treatments before the bonding of IPS Empress II laminate veneers: (1) Laser radiation from Femtosecond laser unit; (2) Laser radiation from Er:YAG laser unit. Eleven specimens received no surface treatment and served as the control group. The veneers were cemented with dual-polymerizing resin (Variolink II veneer, Ivoclar). One microtensile specimen from each of the middle thirds measuring 1.2 x 1.2 mm was prepared with a slow-speed diamond saw sectioning machine with a diamond-rim blade. The specimens were fractured under tension at a crosshead speed of 1 mm/min. The data were analyzed with One-way ANOVA and Tukey HSD tests (alpha=.05).

**Results** No statistically significant differences were found between the bond strengths of Er:YAG laser and control group (P>.05). Statistically significant differences were found between the bond strengths of Femtosecond laser group and Er:YAG laser group (P<.05).

**Conclusions** Microtensile bond strength of porcelain laminate veneers bonded to tooth surfaces that were Er:YAG laser-etched showed results similar to control group. The innovative finding of this study is Femtosecond laser showed the highest bond strength results compared with the other groups.

**0231**

**Effect of different surface treatments on the shear bond strength of resin cement to zirconia ceramic and metal alloy**

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**Objectives** Surface treatment is an important factor to achieve superior bond strength between resin cement and restoration. The purpose of this study was to compare and evaluate the effects of various surface treatments on the shear bond strength (SBS) of zirconia ceramic and metal alloy.

**Methods** Sixty disc-shaped specimens (10 mm x 3 mm) were prepared from zirconia ceramic (Vita In-Ceram YZ) and metal alloy (Kera N). Each type of materials divided into three subgroups (n=10) according to the surface treatments: Er:YAG laser (Er), femtosecond laser (Fs), sandblasting (S). After surface treatments, SEM images were taken at 500x magnification for one specimen of each group. Self-adhesive resin cement (Rely X U200) was bonded to specimens using a teflon mold (3 mm height, 4 mm diameter). Specimens were stored in distilled water at 37°C for 24 h and then thermal cycled for 5000 cycles between 5-55°C. The SBS was measured by applying force at the speed of 1 mm/min using a universal testing machine. The data were analyzed by Kruskal-Wallis and Mann-Whitney U tests (p=0.05). Additionally failure modes (adhesive, cohesive or mixed) evaluated for each specimen. Results Sandblasting resulted in higher shear bond strengths compared to laser treatments. Fs groups of each material showed significantly higher SBS values than Er groups. Metal Fs group showed higher SBS values compared with zirconia Fs group (p<0.05).

**Conclusions** According to the results of this study it can be concluded that sandblasting is more effective surface treatment procedure for metal and zirconia rather than Er:YAG and femtosecond laser irradiations. Femtosecond laser is more effective than Er:YAG laser for shear bond strength of resin cement to zirconia and metal surface.

**0233**

**Effect of surface treatments and artificial aging on the flexural strength of different Y-TZP ceramics.**

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**Objectives** Surface treatments and artificial aging could affect the mechanical properties and survival of the Y-TZP ceramics. The aim of this study was to investigate the effect of surface treatments and artificial aging on flexural strength, fracture probability and Weibull modulus of different zirconia ceramics.

**Methods** Two hundred eighty bar-shaped specimens from four ceramics (Prettau (Pr), IPS e.max ZirCAD (IZ), Vita In-Ceram YZ (VZ) and Lava (L)) were prepared and divided into seven groups (n=10) according to the surface treatment and artificial aging used; Gr1 (control; no treatment), Gr2 (sandblasting), Gr3 (sandblasting+aging), Gr4 (grinding), Gr5 (grinding+aging), Gr6 (Er:YAG laser), Gr7 (Er:YAG laser+aging). Aging procedure included 10000 thermal cycling (5-55 °C) and 100000 mechanical loading (50 N). All of the specimens were subjected to a three point bending test and loaded until fracture according to ISO 6872. Data were analyzed using ANOVA, Kruskal-Wallis, Tukey HSD and Dunn's/Bonferroni test (p<0.05). The variability of flexural strength values was analyzed using Weibull distribution function and Weibull modulus (m) calculated for each group.

**Results** Grinding groups showed lower flexural strength values compared with the other groups. Although sandblasting slightly increased the strength, there were no significant difference between control and sandblasting groups. Laser irradiation was not effective on flexural strength (p>0.05). Artificial aging did not affect the flexural strength compared with the non-aged groups. According to the Weibull analysis, VZ-Gr1 showed the highest m value (22.24). Grinding procedure decreased the m values in each material compared with the control groups. **Conclusions** It can be concluded that grinding is a detrimental procedure for Y-TZP ceramics. The low m of grinding groups may indicate further weakening of the materials, resulting in unexpected failures.

0234

**The effect of different Er-YAG laser pulse modes on the composition of dentin**

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**Objectives** The aim of this study was to evaluate the mineral content and Ca/P ratio of dentin after the irradiation with different Er-YAG laser pulse modes.

**Methods** Method: Ten freshly extracted mandibular first molar teeth were used for this study. The enamel of the teeth was removed using a slow speed diamond saw and a precise cutting machine in order to expose middle-depth flat dentin surfaces. Later, horizontal dentin layers of 1 mm in thickness were obtained from each tooth. The surface of each specimen was marked out as to be four different treatment areas and following surface conditioning procedures were performed: Group 1: untreated control, Group 2: acid etching (37% H<sub>3</sub>PO<sub>4</sub>), Group 3: MSP mode irradiation (120 mJ, 10 Hz, 100 µs) Group 4: QSP mode irradiation (120 mJ, 10 Hz, long pulse divided into short pulse durations). The laser etching process in group 3 and 4 were performed using the contact hand piece (H14C) of the device with a sapphire tip of 1 mm in diameter. The air flow rate was 5 and the water flow rate was 5 as well. After the surface conditioning processes, the specimens were examined under a SEM with 1000x magnification and the chemical composition of the specimens were evaluated with EDS analysis. The data were analyzed with one-way ANOVA and post-hoc test

**Results** Results: There were no significant differences between the groups with regard to Mg, O, C, Ca, P content and Ca/P mineral ratio of the specimens (p>0.05).

**Conclusions** Conclusion: This study has demonstrated that, Er:YAG laser irradiation with different pulse modes used in this study did not affect the compositional structure of dentin surfaces.

0235

**Effect of hyaluronic acid on bone formation in the expanded midpalatal suture in rats**

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**Objectives** The aim of this study was to evaluate the histomorphometric effects of hyaluronic acid solutions with different molecular weights on bone formation in response to expansion of the midpalatal suture in rats.

**Methods** Twenty-four male Sprague-Dawley rats were separated into 3 groups. Each group was subjected to expansion for 5 days and retention for 10 days. Group 1 received 50 µl of high molecular weight hyaluronic acid (HMWHA), group 2 received 50 µl of low molecular weight hyaluronic acid (LMWHA) and the control group received same amount of saline solution to the midpalatal suture. After the 10<sup>th</sup> day of injection, rats were sacrificed and their maxillas were dissected. For the histomorphometric evaluation, blocks were serially sectioned at 10 µm intervals. Sections were stained with Hematoxylin-eosin (HE) and evaluated with the image analysis software program. Bone area (µm<sup>2</sup>) (BA), bone perimeter (µm) (BP), number of osteoblasts and number of capillary cells were measured for each group. Ratio of osteoblast cells and capillary cells to BA and BP parameters were evaluated. **Results** HMWHA showed statistically higher osteoblast and capillary cell scores compared with the LMWHA and control groups (p<0.05). There were no statistically significant differences in between LMWHA and control groups (p>0.05).

**Conclusions** Local injection of HMWHA in midpalatal suture area after rapid maxillary expansion, stimulated new bone formation.

0236

**Micro-CT Analysis of Mandibular Bone of Rats Exposed to Different Chronic Fluoride Doses**

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**Objectives** The aim of this study was to evaluate toxic effects of fluoride on mandibular bone tissue of rats that received chronic fluoride (F) doses pre and postnatally.

**Methods** In this study, female rats received 0, 30 and 100 ppm F ad libitum in drinking water, throughout the gestation and nursing periods. Offsprings received the same water regimen after weaning and were followed up at 1st, 3rd and 5th months. The hemi-mandibles of the rats were dissected and analyzed by microcomputed tomography (micro-CT) to evaluate the bone mineral density (BMD) of mandibular condylar and angular process, furcation and septum areas of first and second mandibular molar teeth using hydroxyapatite phantom models for the BMD calibration.

**Results** All animals from the F groups presented enamel fluorosis with various degrees of defects, thus indicating fluorosis model was successfully formed. It was found that in mandibular bone tissue elevated fluoride doses resulted in a statistically significant increase in BMD values. In 30 ppm F groups an increase was observed in BMD values as compared to control groups whereas a decrease was detected in BMD values in mandibular bone tissue in 100 ppm F group at the 5th month.

**Conclusions** In conclusion, prolonged exposure to F in drinking water at high doses adversely affected the mandibular bone structures and mineral density.

0237

**Treatment of mandible fracture of a 2-year-old child with non-invasive technique: A case report**

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**Objectives** The pediatric mandibular fractures can cause a child severe pain and difficulty in nutrition. Pediatric mandibular fractures can have variable etiologies but have similar manifestations as those in adult patients. Due to a number of factors, including the anatomical complexity of the developing mandible in a child, management of such fractures differs from that of adults. The aim of this presentation was to show the closed treatment method of a pediatric mandible fracture.

**Methods** Treatment of a 2-year-old child with parasymphysis fracture with acrylic occlusal plate were discussed with literature. **Case Report:** A 2-year old male patient was referred to our clinic with complain of ecchymosis and swelling on his mandible. Fracture at parasymphysial area was diagnosed by bimanual examination of mandible and maxillofacial computed tomography. The acrylic occlusal plate of mandible was prepared after taking impression with functional occlusion of mandible and maxilla.

**Results** The fractured segments were in good approximation and the occlusion was stable. The patient's occlusion fitted nonsurgically and perfectly.

**Conclusions** Non-invasive techniques can be an effective and safe treatment option in children's maxilla-facial fractures. With these kinds of non-invasive techniques an aesthetic and functional occlusion can be achieved.

0238

**Dentofacial Discrepancy Assessment in Relation to Hyoid bone using CBCT Algorithm: A Retrospective Case-Control Study in Turkish Population.**

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**Objectives** To obtain a quantitative anatomical description of the hyoid bone to neck and facial pattern discrepancy with four landmarks represented by posterior nasal spine (PNS) and cervical maximum height (C1) superiorly and hyoid centric relation (HCR) with cervical maximum height (C4) inferiorly in linear and vertical relations of sagittal and axial view using CBCT algorithmic scales.

**Methods** CBCT images of 220 patients , involving 132 routinely patient ( as control group ) and 88 dentofacial discrepant patients ( as study group ) images were reconstructed using PLANMECA ROEMIX 2.9.2.R image viewer software . A linear relations were (PNS-C1) is symbolized as (L1) , (HCR-C4) is (L2) and vertical relation were (PNS-C4) is (Y1) and (HCR-C1) is (Y2) were carried out using metric and morphological analyses for assessment in three age groups ( 6 - 9 , at 9 and 9 -12 years olds ) .

**Results** Hyoid linear(L2) and vertical(Y1) relation are slightly lower ( $L1 > L2$ ) and ( $Y2 > Y1$ ) in female than male with median values ( 3.5 / 4.5 mm) linearly and vertically ( 8.33 / 12.20 mm ) respectively, whereas Hyoid is more anteroinferior in male at vertical relation esp. third age group as an indicator of Hyomandibular attached musculatures' compartments compensation effect through discrepancy with age .

**Conclusions** within limit of this study methodology is too important to use predictive values for perspective hyoid musculoskeletal harmony in relation to neck and facial pattern assessment esp. orthodontics , orthognathic surgery and sleep apnoea .

age relate Hyoid Dentofacial relation in female study group

age group	L1	L2	Y1	Y2
TYPE 1 ( UNDER 9 YEARS OLD)	31.3	25.7	55.4	62
TYPE 2 ( AT 9 YEARS OLD)	33.3	28.1	54.9	51
TYPE 3 ( OVER 9 YEARS OLD )	41.4	36.2	67.6	72.3

age relate Hyoid Dentofacial relation in male study group

AGE GROUP MALE	L1	L2	Y1	Y2
UNDER 9 YEARS OLD	35.1	31.3	50.9	69
AT 9 YEARS OLD	34.2	32.7	50.4	66.2
OVER 9 YEARS OLD	40.8	41.4	76.3	79.9

**0239**

#### Fluoride Releasing Capacity and Recharge Potential of Orthodontic Sealants

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**Objectives** The aim of this study was to compare in-vitro fluoride releasing capacity of two orthodontic sealants and evaluate their recharge potential after fluoride application.

**Methods** 20 discs from orthodontic sealants (Ortho Coat (O) and Pro Seal (P); n:10 each) were prepared and stored in artificial saliva for 8 weeks. During this period, daily fluoride release of the specimens was determined using Ionized Selective Electrode (Thermo Orion 9609BN). A total of 80 discs prepared from the same sealants (n:40 from each) and stored in artificial saliva for 1 week, were divided into 5 groups (n:8) according to the fluoridated material used for the recharge. Then fluoridated toothpaste (Colgate Total; TP) was applied twice a day for 2 minutes (PTP and OTP), whereas fluoridated mouthrinse (Colgate Plax; M) (PM and OM) and CPP-ACP/F (MI Paste Plus; MI) (PMI and OMI) were applied once a day on to the specimens. The combined use of the toothpaste and mouthrinse (PTP+M and OTP+M) and the toothpaste and CPP-ACP/F (PTP+MI and OTP+MI) were applied similar to their corresponding groups. Fluoride releasing and recharge potential data were analyzed using repeated ANOVA and Bonferroni tests ( $p < 0.05$ ).

**Results** O presented significantly more fluoride release compared to P in the first three days, however a significantly lower release was observed in the last two weeks ( $p < 0.05$ ). Fluoride releasing levels of both sealants showed statistically significant increase on the first day after all the fluoride applications ( $p < 0.001$ ) however fluoride releasing levels of OTP, OM, OMI, OTP+M and OTP+MI groups were lower than the maximum amount of fluoride release of O on day 1 ( $3.3950 \pm 1.5447$  ppm) ( $p < 0.01$ ).

**Conclusions** Ortho Coat had higher initial burst effect and lower fluoride release in long term compared to Proseal. Proseal and Ortho Coat can be recharged by different fluoride applications.

**0240**

#### Impact of a New Calcium-based Agent on The Enamel After Bleaching

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**Objectives** This study evaluated the impact of a newly developed calcium-phosphate desensitizer Teethmate Desensitiser on bleached enamel surface hardness, and compared it to that of Pro-argin, acidulated phosphate fluoride (APF), and casein phosphopeptide-amorphous calcium-phosphate (CPP-ACP).

**Methods** Twenty bovine incisors were cut into four pieces (4x4x4mm), embedded, and then bleached with either hydrogen peroxide (in-office bleaching, HP40%) or carbamide peroxide (at home bleaching, CP16%). After bleaching, the specimens were divided into five treatment subgroups (n=8 each): Group1-no treatment (control); Group2-Teethmate Desensitiser; Group3-Pro-Argin; Group4-CPP-ACP; Group5-APF. The enamel slabs were stored in artificial saliva during the bleaching. Microhardness values were evaluated using a microhardness tester before and immediately after treatment. Statistical analyses were performed using the paired *t*-test, one-way analysis of variance, and post-hoc Tukey tests.

**Results** The 40%HP decreased the enamel microhardness compared to their baseline data, whereas 16%CP did not change the microhardness. There were no significant differences among effects of treatment agents on softened enamel ( $p > 0.05$ ), but CPP-ACP showed the most improvement.

**Conclusions** Teethmate Desensitiser appears to restore enamel hardness following office bleaching. Mineralisation agents may not be required for at-home bleaching.

0241

### **Short-term Clinical Efficacy of Two Topical Treatments for Dentine Sensitivity**

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**Objectives** To evaluate the effectiveness of two topical treatments in providing short-term relief dentin hypersensitivity.

**Methods** A total of 40 male and female subjects (20/20, aged between 35-55 years, each having at least 2 sensitive teeth in each quadrant) with dentine hypersensitivity were recruited. Subjects were randomized to treatment with either Duraphat (fluoride varnish) and Pro-Relief (8% arginine and calcium carbonate) (Colgate). Without any systemic disease and bruxism, received a professional dental scaling patients were participated in the study. The assigned pastes were applied at the final step to the professional dental cleaning procedure. Hypersensitivity was assessed by Visual Analogue Scales (VAS) to record pain following stimulation of exposed dentine surfaces by tactile, air blast, water spray (3-way syringe) and thermal stimulus (+4 °C water). VAS was used at four points at time. The first being just before the treatment to establish baseline, 30 minutes post-treatment, 14 days post-treatment and the last 60 days post-treatment.

**Results** Subjects exhibited a statistically significant hypersensitivity improvement from baseline. In the group that Duraphat applied in the first 30 minutes there were no statistically significant differences in subjects. The 14 day and 60 day hypersensitivity scores were statistically significant improvements from the baseline. The other group that Pro-Relief applied in the first 30 minutes and 14 days after product application there were statistically significant improvements from the baseline but 60 days later there were no statistically significant differences in hypersensitivity scores according to the baseline.

**Conclusions** Both of the treatments were improved hypersensitivity scores. Pro-Relief was found successful in short term application but if not reapplied regularly hypersensitivity scores may return to the baseline. Duraphat may be more secure to practice one time application.

0242

### **Effect of Sodium Fluoride on the Endogenous MMP Activity of Dentin**

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**Objectives** The progressive degradation of bonded interfaces is thought to be due, in part, to the hydrolytic action of endogenous matrix metalloproteinases (MMPs) in hybrid layers. Sodium fluoride (NaF) was shown to inhibit salivary MMP-2 and MMP-9, however the effect on matrix-bound MMPs in dentin is not known. This study evaluated the effect of incorporating different concentrations of NaF in incubation media, on the dry mass loss and total MMP activity of the demineralized dentin over time.

**Methods** Dentin beams (1×2×6mm) demineralized in 10% phosphoric acid (24 h) rinsed. Baseline total MMP activity of each beam was analyzed by colorimetric assay (Sensolite®, AnaSpec Inc. Fremont, CA) and dry mass was measured. Then, the beams were assigned to different groups so that the baseline activity and dry mass is similar between the groups (n=10/group). Beams were incubated at 37 °C in an 1mL of artificial saliva (AS, control) or AS containing 500, 1000, 2000, 5000, 7500 or 10000 ppm NaF for 1, 7 and 21 days. The total MMP activity and dry mass loss was reassessed after each incubation period. The data were analysed using ANOVA and Tukey HSD tests at  $\alpha=0.05$ .

**Results** The cumulative mass loss were 4.73(±1.27)%, 7.53(±1.68)%, 10.84(±1.70)% in the control group for 1, 7 and 21 days respectively, and ranged between 7.44(±1.21)% and 6.73(±1.01)% for the NaF groups after 21 days of incubation, which was statistically significant for all NaF groups ( $p<0.05$ ). The total MMP activity of the control group was stable over 21-day incubation period, whereas NaF inhibition ranged between 5-80%. Both NaF concentration and incubation time showed significant differences in inhibition ( $p<0.05$ ).

**Conclusions** The results of this study indicate that NaF inhibits matrix-bound MMPs over time and therefore may slow the degradation of dentin matrix by endogenous dentin MMPs.



0243

### **In Situ Remineralization of Eroded Enamel by Nano-Hydroxyapatite Toothpastes**

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**Objectives** An in situ study evaluated the remineralization effects of two nano-hydroxyapatite (n-HAP) toothpastes with and without fluoride and one sodium fluoride toothpaste on eroded enamel.

**Methods** This was a single-blind, randomized, cross-over study consisting of three treatment periods separated by one week washout period and each lasting one week. Twenty-one healthy young adult volunteers wore palatal appliances for eight hours/day, each containing five human enamel blocks. The appliances were immersed in a soft drink for five minutes four times a day. In each treatment period, participants brushed enamel blocks with the following toothpastes for two times daily; ApaCare (1450 ppm F as NaF/1% n-HAP), Prevdent (2.25% n-HAP), and Paradontax (1400 ppm F as NaF). After each period, appliances were removed and vickers hardness number (VHN) and scanning electron microscopy (SEM) images were evaluated of the enamel surfaces.

**Results** There were significant differences in VHN values between those obtained before and after the remineralization procedure ( $p < 0.05$ ). After one week of in situ treatment significantly greater hardening was found in the samples treated with n-HAP toothpastes than treated with standard fluoride toothpaste ( $p < 0.05$ ). Results obtained by SEM analyses demonstrated that the hydroxyapatite containing toothpastes were efficient in promoting enamel remineralization by formation of deposits on the surface of the enamel.

**Conclusions** It is concluded that the toothpastes containing nano-hydroxyapatite are able to re-harden eroded tooth enamel and can be considered as a new approach to remineralize of the demineralised enamel.

0244

### **Effect of fluoride varnish on surface conditioning of artificial enamel carious lesions**

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**Objectives:** White spot lesions, which often occur during orthodontic treatment around brackets, are often treated minimal invasively using resin infiltration. Before infiltration the enamel surface layer has to be removed. It was the aim of this preliminary study to investigate the influence of fluoride varnish treatment on the enamel surface conditioning prior to resin infiltration.

**Methods:** Of 10 extracted caries free human molars artificial carious lesions were prepared on the buccal and lingual surfaces. Both windows were treated with fluoride varnish (Elmex Fluid, CP GABA, Hamburg, Germany) containing 12000 ppm amine fluoride and the buccal surface was conditioned using 15 % hydrochloric acid (HCl) (Icon etch®, DMG, Hamburg, Germany) for 1x 2, 2x2, 3x 2 and 4x2 minutes. The lingual/palatine window was not conditioned. The surface roughness was determined after each treatment step and compared statistically with the non-parametric sign test for related variables. The teeth were sectioned through the lesions into 80µm slices and investigated with polarized light microscopy (PLM).

**Results:** No significant difference in the surface roughness was determined after each treatment step compared to sound enamel. PLM revealed a clearly demarcated hypermineralized enamel surface layer after treatment with Elmex Liquid, which could not be removed after 1x2 minutes acid etching. After 2x2 minutes etching with Icon etch the surface layer was dissolved.

**Conclusions:** Preventive fluoridation of the enamel surface results in a denser surface layer of white spot lesions which prolongs the time for conditioning the enamel surface.

0245

### **Evaluation of Antibacterial Effect of Cements Using Agar Diffusion Test**

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**Objectives** Seconder caries and apical lesions can be occur around the restoration, fixed prosthesis, post-core restoration and orthodontic bands margins because of cariogenic bacteria. The aim of this study was to assess the antibacterial activities of different adhesive cement systems Clearfil™ Esthetic Cement, Multilink® Automix, Unitek™ Multi Cure, Poly F Plus, Panavia™ F 2.0, Variolink® II, Rely X™, Zinc Phosphate, BisCem® and as a control group Zinc Oxide Eugenol cement using agar diffiusion test (ADT).

**Methods** The test materials were inserted in the wells of Muller Hinton agar plates inoculated with *Staphylococcus Aureus* and *Enterococcus Faecalis*. The diameters of the inhibition zones produced around the materials were measured after 24 h of incubation. The results were analyzed by the Two way ANOVA, Kruskal Wallis and the

Mann-Whitney tests at a significance level of  $P < .001$ . All results were corrected for multiple comparisons using the Bonferroni method.

Results Poly F Plus and BisCem cement exhibited a significant differences from the other groups against both *S. Aureus* and *E. Faecalis* ( $P < .001$ ) While the zone of inhibition of Poly F Plus cement was shorter than control group (zinc oxide eugenol) for *S. Aureus*. *S. Aureus* displayed a significantly lower resistance to Panavia F 2.0 ( $10.73 \pm 2.52$ ), BisCem and Poly F Plus than *E. Faecalis* ( $P < .001$ ).

Conclusions Of the materials tested, only the Poly F Plus, BisCem, Unitek Multi Cure, exhibited greatest in vitro antibacterial activity against both *S. Aureus* and *E. Faecalis*. According to the results of present study; when post and crowns bonded with these cements, the seconder caries which formed by anaerobic bacteria could be suppressed.

0246

**Comparasions of the Saliva and Gingival Crevicular Fluid Immunoglobulin A Levels in Caries Free and Caries Active Persons**

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**Objectives** Secretory IgA is the main type immunoglobulin in saliva and is considered as the main secretion factor of the adaptive immunity in the mouth. The aim of the study was to compare the salivary IgA and Gingival Crevicular Fluid (GCF) IgA levels in caries active and caries free persons.

**Methods** Thirty children in the age group of 15-40 years were selected and divided into two groups, Group I caries free, (DMFT =0) and Group II caries active, (DMFT >10). Unstimulated saliva and GCF samples were obtained. Clinical parameters, plaque index (PI), gingival index (GI), and salivary flow rate were determined. The levels of S. mutans and lactobacillus were determined by culture on Mitis-Salivarius Bacitracin agar and Rogosa agar. GCF samples were obtained with periopaper strips from relevant teeth for IgA measurements. Each sample was stored at -80°C and analyzed using the enzyme-linked immunosorbent assay (ELISA). Data were analyzed using the independent t-test and  $\chi^2$  test at a significance level of  $\alpha=0.05$ . Associations between parameters were analyzed using Pearson correlation analysis.

**Results** GCF volume, GI and PI values of caries active group were significantly higher than caries free group ( $p<0.05$ ). Although lactobacillus counts of caries active group were higher than caries free group, no statistically significant differences were observed for microorganism counts and salivary flow rate between the groups ( $p>0.05$ ). GCF and salivary IgA levels were no statistically significant between the groups ( $p>0.05$ ).

**Conclusions** The present study showed that high S. mutans and lactobacillus levels in the saliva did not by themselves influence the DMFT index. There is no dependence between secretory immunity and dental caries in persons.

0247

**In situ Evaluation of Biofilm on Sealant Materials with or without a HAP-containing Paste**

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**Objectives** The aim of this study was to evaluate the amount of biofilm formed *in situ* on two resin fissure sealants (RS1:Helioseal F, RS2:Ultrasal XT Hydro), a glass-ionomer sealant (GS:Fuji Triage) and a biomimetic hydroxyapatite (BHAP) block imbedded in upper appliances of 20 children and to compared them when HAP particles containing pastes (Remin pro Voco) are used by same children overnight.

**Methods** Intraoral palatal removable appliances were made for 20 children aged between 8-10 years attending to the Department of Pediatric Dentistry of Marmara University, Istanbul, for dental treatments and occlusion guidance. Ethical approval was taken and consent forms were signed by parents. Dental material samples from RS1, RS2, GS and BHAP blocks as a control were placed on these appliances. Children were instructed to used them all day and night except mealtimes for a week. Samples then were removed carefully and the same appliances were used again with new blocks for 7 days while children were instructed to apply each night a HAP particles containing paste. After been taken from appliances, all blocks were analyzed by SEM imaging and evaluated using a picture processing program (image J).

**Results** The biofilm formation was seen on all materials. With the use of HAP particles the biofilm formation was significantly decreased on the all fissure sealant materials and BHAP blocks ( $p<0.05$ ). Even though there was no statistically significant difference between fissure sealant materials and BHAP blocks under the two conditions ( $p>0.05$ ) the amount of biofilm was highest on GS, followed by FS2, FS1 and least on BHAP.

**Conclusions** HAP particles containing paste seemed to reduce the amount of the biofilm formation on all fissure sealants and BHAP blocks *in situ*.

0248

**Effect of probiotic *Lactobacillus rhamnosus* GG on oral biofilm model**

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**Objectives** Probiotics have shown favourable properties in maintaining oral health. By interacting with oral microbial communities these species could contribute to healthier microbial equilibrium. The aim of our *in vitro* study was to investigate the ability of probiotic *Lactobacillus rhamnosus* GG (L.GG) to integrate in biofilm and affect its species composition. We hypothesized that the probiotic inhibits other strains in the model.

**Methods** Five oral strains (4 bacteria and 1 yeast), *Streptococcus mutans*, *S. sanguinis*, *Aggregatibacter actinomycetemcomitans*, *Fusobacterium nucleatum* and *Candida albicans* were used in the biofilm model. Five strains and L.GG were grown in their respective culture media till late log-phase, then harvested and re-suspended in biofilm medium to McFarland standard 1. Biofilm was grown on saliva-coated hydroxyapatite (HA) discs at 37°C in anaerobic conditions. Biofilm model without strains was used as a negative control. Biofilm medium was added and refreshed at 0, 16.5, 40.5 and 64.5 h. The pH of spent medium was measured after each time point. Viable cells in biofilms were harvested and counted at 16.5 and 64.5 h. LIVE/DEAD® BacLight™ Bacterial Viability Kit solution staining and confocal laser scanning microscopy were performed on three-day old biofilms.

**Results** A pH decrease from 7.00 to 5.93 and 5.10 after 16.5h and 40.5h, respectively, was measured in the five-species biofilm and the values remained stable afterwards. The presence of L.GG did not markedly affect the pH values and viable cell counts recovered from HA discs. The adhesion abilities of L.GG and *S. mutans* were stronger than that of the rest of the strains in mono-species biofilms.

**Conclusions** L.GG successfully integrated in six-species biofilm but contrary to our expectations no inhibitory effect was detected in the present model system.

0249

**AN ALTERNATIVE OPTION TO MOUTHWASHES: CHITOSAN AND GRAPE SEED EXTRACT**

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**Objectives** The aim of this study is considering the side effects of the antimicrobial efficacy of mouthwashes on the market, prepare an antimicrobial solution containing the chitosan reported no side effects and grape seed; the antimicrobial activity of this solution to compare with other antimicrobial mouthwashes commercially.

**Methods** In this study, 2% chitosan, grape seed extrat, 2% chitosan and grape seed extract, and the mountwashes that the active agent is chlorhexidine digluconate (Klorhex), essential oils (Listerin), essential oils+ floride ( Listerine Zero), cetylpyridinium chloride (Scope), triclosan (Colgate Plax) and ve sodium flouride's (Signal) antimicrobial activity on *S. mutans* were examined using the agar diffusion method. After opening the wells with a diameter of 1 cm of medium *S. mutans* were inoculated and antimicrobial solutions were placed in the wells. After 24 hours incubation, the inibition zones were measured and photographed. The obtained data were analyzed using ANOVA and Bonferroni statistical tests.

**Results** The effects of mouthrinses, grape seed extrate and chitosan on *S. Mutans* are as follows that; chlorhexidine (positive control group) > essential oils+ fluoride> chitosan > triclosan > cetylpyridinium chloride > grape seed extrate+ chitosan> grape seed extrate > essential oils = water (negative control group) = lactic acid.

There is no istatistically significant differences between chlorhexidine and essential oils+ fluoride ( $p>0.05$ ). There is no istatistically significant differences between chitosan, triclosan, cetylpyridinium chloride ( $p>0.05$ ). The results revealed that there is no istatistically significal differences between grape seed extrate+ chitosan and grape seed extrate ( $p>0.05$ ).

**Conclusions** Chitosan were found to be more effective on *S.mutans* then many of mouthrinses commercially in vitro. Also chitosan's antimicrobial effect was decreased with grape seed extrate that used for good flavor and increase the antimicrobial effect of chitosan.

0250

**Polyaspartic acid improves dentin remineralization ability of a zinc-doped Portland-based cement.**

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**Objectives** To ascertain if applying biomimetic analogues (poly-L-aspartic acid -PAS- and sodium trimetaphosphate -TMP-) may improve bonding efficacy and remineralization ability of a novel zinc-doped Portland-based resinous sealing cement.

**Methods** Bonding procedures were performed on phosphoric acid etched dentin and different groups were established: 1) distilled water (DW) application, 2) PAS application and 3) a mixture of PAS and TMP was used. Raman spectroscopy and microtensile bond strength (MTBS) with fracture analysis by scanning electron microscopy were executed.

**Results** MTBS values (MPa) were not affected by the different bonding procedures at 24 h testing (DW:34.1[3.1]; PAS: 33.3[7.2]; PAS/TMP:28.2[3.1]), but after 6 m only PAS-treated dentin attained no significant bond strength reduction, and was the highest mean value between groups (DW:24.1[3.5]; PAS:34.0[3.8]; PAS/TMP:24.4[5.6]). The novel material bonded without primers application induced crystals precipitation onto the etched dentin, and augmented crystallinity (FWMH) at the hybrid layer (956 cm<sup>-1</sup> FWMH 24h: 38.74 and after 1m:20.52). Mineral to matrix ratio (MMR) was highly increased at the hybrid layer of the PAS-treated specimens (MMR 24h: 0.72 and after 1m:5.40); this primer was also able to catalyze dentin remineralization, without any increase in crystallinity (FWMH) (956 cm<sup>-1</sup> FWMH 24h:35.55 and after 1m:45.72).

**Conclusions** Microfillers incorporated into the novel material were able to set, forming bioactive crystals (calcium carbonate and Ettringite), preferentially located, inside dentinal tubules. PAS application onto demineralized dentin produced inhibition/delay of released ions crystallization, increasing the remineralization potential of the Portland microfillers. Supported by MINECO/FEDER MAT2011-24551 and MAT2014-52036-P.

0251

**Mechanical, chemical and morphological analysis of caries-affected dentin bonded with a Zn-doped resin.**

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**Objectives** To evaluate the resin-dentin bond strength and the ability of an etch-and-rinse zinc-doped adhesive to induce functional remineralization at the bonded dentin interface created by using two different demineralization procedures of the caries-affected dentin (CAD) surface, and after *in vitro* mechanical loading application.

**Methods** CAD surfaces were subjected to demineralization treatments: 37% phosphoric acid (PA) and 0.5 M ethylenediaminetetraacetic acid (EDTA). Single bond (SB) adhesive -3M/ESPE-, SB+ZnO particles 20wt% and SB+ZnCl<sub>2</sub> 2wt% were applied on treated CAD to create groups: PA+SB, PA+SB-ZnO, PA+SB-ZnCl<sub>2</sub>, EDTA+SB, EDTA+SB-ZnO, EDTA+SB-ZnCl<sub>2</sub>. Interfaces were submitted to mechanical loading (load cycled) or stored in simulated body fluid during 24h (unloaded), and then tested. AFM analysis, Raman spectroscopy, Masson's trichrome staining and microtensile bond strength (MTBS) with fracture analysis by scanning electron microscopy were executed.

**Results** MTBS values (MPa) were not affected by load cycling (PA+SB unloaded: 23.4[2.9]; PA+SB load cycled: 20.9[3.3]; PA+SB-ZnO unloaded: 17.7[2.3]; PA+SB-ZnO load cycled: 16.8[3.7]; PA+SB-ZnCl<sub>2</sub> unloaded: 15.8[2.0]; PA+SB-ZnCl<sub>2</sub> load cycled: 17.7[4.4]; EDTA+SB unloaded: 21.7[2.3]; EDTA+SB load cycled: 21.2[3.7]; EDTA+SB-ZnO unloaded: 15.0[3.0]; EDTA+SB-ZnO load cycled: 15.5[3.5]; EDTA+SB-ZnCl<sub>2</sub> unloaded: 19.4[3.2]; EDTA+SB-ZnCl<sub>2</sub> load cycled: 22.2[3.6]). Load cycling increased mineralization, reducing crystallographic maturity (FWMH) (956 cm<sup>-1</sup> FWMH- PA+SB unloaded: 29.93; PA+SB unloaded: 22.58; PA+SB-ZnO unloaded: 19.27; PA+SB-ZnO load cycled: 19.31; PA+SB-ZnCl<sub>2</sub> unloaded: 22.49; PA+SB-ZnCl<sub>2</sub> load cycled: 19.31; EDTA+SB unloaded: 16.13; EDTA+SB load cycled: 19.32; EDTA+SB-ZnO unloaded: 16.07; EDTA+SB-ZnO load cycled: 19.29; EDTA+SB-ZnCl<sub>2</sub> unloaded: 25.71; EDTA+SB-ZnCl<sub>2</sub> load cycled: 19.29). Crosslinking showed higher frequencies and better conformation and organization of collagen in PA+SB-ZnO, after load cycling. After trichrome staining, a reduction of the demineralized dentin fringe after load cycling was shown.

**Conclusions** Incorporating zinc into adhesives increases the potential for intrafibrillar remineralization at partially demineralized collagen matrices of CAD. Grants MINECO/FEDER MAT2011-24551 and MAT2014-52036P.

0252

### **Influence of Dispensing Time on Shear Bond Strength of Contemporary Adhesives**

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**Objectives** To evaluate the effect of various dispensing times of one bottle and two bottle adhesives in a dark environment before usage on their shear bond strength to dentin.

**Methods** Ninety-six caries free extracted third molars were collected. Flat dentine surfaces were created on mid-coronal dentin using a slow speed diamond saw (Isomet, Buehler, USA) and polished with wet 600-grit silicon carbide paper to create standardized surfaces. Teeth were randomly assigned to two groups (n=48) and either Clearfil SE Bond (SE-Kuraray, Japan) or Single Bond Universal (UB-3M ESPE, Germany) was applied to the dentin surfaces after dispensing adhesives into special light blocking plate for 20 min, 10 min, 5 min or fresh according to the manufacturer instructions'. Next, a resin composite (Universal Restorative, 3M ESPE, Germany) was built up on the dentin of each specimen by packing the material into a cylindrically shaped plastic apparatus with an internal diameter of 2.34 mm and a height of 3 mm and light-cured with an LED for 20 s. All specimens were stored in a moisture medium at 37 °C for 24 h. Shear bond strength was tested using a Universal Testing Machine (Instron, USA) with a crosshead speed of 1 mm/min. Data were analyzed with *two-way ANOVA* and post hoc Tukey HSD tests (P=0.05).

**Results** Statistical significant difference was found between the two adhesive agents tested (P<0.05). Statistical significant difference was found between the various dispensing times (P<0.05). Highest bond strength values were obtained when adhesives were used as soon as they were dispensed ( $12.23 \pm 3.50$  for SE,  $7.99 \pm 1.95$  for UB). Lowest bond strength values were obtained when adhesives were used after 20 min of their dispensing ( $6.81 \pm 2.29$  for SE,  $4.42 \pm 1.47$  for UB).

**Conclusions** Adhesives should be use as soon as they are dispensed for better dentin adhesion

0253

### **Effects of Different Er,Cr:YSGG Laser Parameters on Resin-Enamel/Dentin Bond Strength**

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**Objectives** The purpose of the present study was to evaluate microtensile bond strength of a microhybrid resin composite restorative materials which is used with an etch-and-rinse adhesive to enamel and dentin after treatment with Er,Cr:YSGG laser with different output power and pulse frequency combinations.

**Methods** Enamel (E) and dentin (D) samples were prepared from bovine incisors. Following immersion of teeth in the acrylic blocks and flattening surfaces, samples were divided into 8 subgroups as following (n=5): E-Control (no treatments), E-Bur (mechanical roughening was performed using high-speed diamond bur), E-Laser 6W-20Hz, E-Laser 6W-35Hz, E-Laser 6W-50Hz, E-Laser 3W-20Hz, E-Laser 3W-35Hz, E-Laser 3W-50Hz; D-Control (no treatments), D-Bur (mechanical roughening was performed using high-speed diamond bur), D-Laser 3W-20Hz, D-Laser 3W-35Hz, D-Laser 6W-50Hz, D-Laser 1.5W-20Hz, D-Laser 1.5W-35Hz, D-laser 1.5W-50Hz. Following acid-etching all surfaces, composite build-ups were done. Samples were cut into resin-enamel/dentin sticks with dimensions of 0.8 mm<sup>2</sup>. Four sticks randomly selected from each tooth (n=20) to be tested in microtensile bond strength test.

**Results** E-Laser 3W-50Hz ( $36.22 \pm 6.0$  MPa) showed significantly highest bond strength with exception of E-Control ( $32.85 \pm 9.8$  MPa). For dentin, E-Control ( $27.70 \pm 7.0$ ) and E-Bur ( $24.98 \pm 8.8$ ) showed significantly different bond strength from other groups.

**Conclusions** As a conclusion, laser irradiation could enhance or impair the microtensile bond strength to depending to the tooth structure and laser parameters used.

0254

#### **Microtensile bond strengths and surface roughnesses for Er:YAG prepared cavities**

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**Objectives** To compare the microtensile bond strengths of Class V cavities prepared by conventional methods or different parameters of Er:YAG laser and restored with composite material following 2000 cycles of thermocyclis. Dentin surface roughness performed by the same Er:YAG parameters and the conventional method was also compared.

**Methods** 45 premolars were selected randomly and sectioned in a mesio-distal direction and were randomly divided into 9 groups consisted of 10 samples each and 5 roughness values of every dentin surface were measured before conventional method and laser irradiation. After embedding all samples in acrylic resin blocks, different Er:YAG parameters and conventional method were applied and 5 surface roughness values were then determined again for every sample. For determination of microtensile bond strengths, 68 premolars were sectioned in a mesio-distal direction and Class V cavities were prepared by Er:YAG laser and conventional method. A bonding agent (Clearfil SE Bond) and a composite material (Filtek Z250) were applied onto the prepared cavities. A universal test machine was used to measure the microtensile bond strength after thermocycling 2000 cycles between 5° C and 55° C. Statistical analysis was performed by using the 'One Way ANOVA' and 'Tukey HSD' tests. The comparison of parameters within groups was analysed with paired t test.

**Results** Statistically, laser irradiated dentin surfaces showed significantly higher surface roughness values ( $P \leq 0.05$ ). For the cavities prepared with laser, there was no statistical difference between lower pulse durations with higher power and higher pulse durations with lower power. Control group showed the highest strength.

**Conclusions** At laser groups, when the surface roughness increased, microtensile bond strength were decreased. These results gives an impression that there might be a reverse relationship between surface roughness and microtensile bond strengths, after Er:YAG irradiation.

0255

#### **Shear Bond Strength of Bulk-Fill Composite and Glass Ionomer Cement to Dentin Treated with Er:YAG Laser and/or Acid**

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**Objectives** The aim of this study was to evaluate the effect of various surface treatments on the bond strength of bulk-fill composite and glass ionomer cement to dentin

**Methods** Eighty molars were selected and the roots were removed. The crowns were embedded in auto-polymerizing acrylic resin with the occlusal surfaces facing up. The occlusal surfaces were ground using low speed diamond saw until the dentin was exposed; the samples were randomly divided into two groups (n=40) according to the materials: (1) glass ionomer cement (Equia, GC Corp., Japan), (2) bulk-fill composite (SDR, Dentsply, USA). Samples of the groups randomly divided into five subgroups (n=8) according to the surface treatment: (a) no acid etching and no laser etching (control group), (b) acid etching (phosphoric acid for bulk-fill, polyacrylic acid for glass ionomer cement) (c) laser etching (100mJ/10Hz) (Deka Laser, Florance Italy) (d) laser etching followed by acid etching, (e) acid etching followed by laser etching. Bulk-fill composite rods (2mm thickness, 3mm diameter) were bonded to treated dentin surfaces with a universal adhesive system (All-bond, Bisco, USA) and light cured. Bond strength was measured with a universal test machine and data were analyzed using One-way ANOVA and post hoc Tukey tests ( $\alpha=0, 05$ ).

**Results** The highest mean shear bond strength for glass ionomer cement was shown in acid etching group (4,  $44 \pm 0, 65$  MPa), while the lowest mean in the control group (1,  $23 \pm 0, 33$  MPa). For bulk-fill composite, the highest mean shear bond strength was shown in acid group (10,  $69 \pm 1, 18$ ), while the lowest mean in the acid+ laser group (6,  $35 \pm 1, 09$  MPa). There were significant differences between acid + laser group and laser + acid groups ( $\alpha=0, 05$ ).

**Conclusions** Acid etching procedure is more effective for increasing bond strength of bulk-fill composite and glass ionomer cement used in this study than laser etching. It is not necessary to etch the dentin surface by Er:YAG Laser following acid etching.

0256

**Effects of Different Combinations of Er:YAG Laser Irradiations and Bonding Agents on The Shear Bond Strengths of Orthodontic Brackets**

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**Objectives** To evaluate the shear bond strengths (SBS) of brackets bonded with the different combinations of Er:YAG laser irradiations and bonding agents.

**Methods** Total of 108 premolar teeth were used in this study. Three main groups were performed according to the etching procedure: (1) no laser (control); (2) 1-W Er:YAG laser; (3) 2-W Er:YAG laser. Each group was divided into three subgroups based on the application of different bonding agents (Transbond XT Primer, Transbond Plus SEP and Clearfil Protect Bond). Metal brackets were bonded with light-cured composite resin (Transbond XT). After bonding, the samples were subjected to 500 thermal cycles and debonded with a universal testing machine and the SBS values were recorded. Modified adhesive remnant index (ARI) scores were used to assess the remaining adhesive. ANOVA and post-hoc tests were used to compare SBS values, Kruskal-Wallis and Mann Whitney U tests were used to analyze the differences in the ARI scores for different bonding procedures.

**Results** Clearfil Protect Bond control group had the lowest SBS values and the highest values were found in the combination of 2-W Er:YAG laser etching with Clearfil Protect Bond. The differences between the mean SBS values except these two groups were not statistically significant ( $p>0.05$ ). More adhesives were left on enamel surfaces in 1-W and 2-W Er:YAG laser etching with Transbond Plus SEP or Clearfil Protect Bond combinations.

**Conclusions** When Clearfil Protect Bond is preferred for bonding agent, Er:YAG laser etching at 1-W is suggested to improve the SBS of brackets.

0257

**Shear strength evaluation of adhesives and bleaching after antioxidant treatment**

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**Objectives** To evaluate shear bond strength (SBS) of a nanocomposite resin which is applied with two adhesives to enamel at the end of different waiting periods after two bleaching treatments with or without antioxidant.

**Methods** 408 extracted human central and lateral teeth were used. The teeth were divided into 34 groups ( $n=12$ ). Two groups which weren't used bleaching treatment were control groups. Home bleaching (Opalescence Oh!) was applied at half and office bleaching (Opalescence Boost PF) was applied at the other half of the groups. After bleaching treatments, at the end of different waiting periods (immediate after bleaching, 1, 2 and 3 week later) antioxidant was applied in the half and was not applied in the other half of the groups. Composite specimens were bonded to enamel surfaces with the self-etch (Adper Easy One) in the half and with the etch&rinse (Adper Single Bond 2) adhesive system in the other half of both antioxidant applied and not applied groups. After SBS test all specimens were examined under a stereomicroscope. One specimen from each group was evaluated with scanning electron microscope. Data were analyzed with ANOVA, Welch ANOVA, Tukey HSD, independent t tests.

**Results** Significantly lower SBS values were observed in teeth immediately bonded after home and office bleaching. Etch&rinse groups resulted in higher SBS when compared with self-etch groups. SBS values of antioxidant groups were not significantly higher than the not applied groups. The groups including delay time of 2 and 3 weeks after bleaching showed increase in SBS in both home and office bleaching.

**Conclusions** Bleaching reduced the SBS in enamel and this reduction was greater for the office bleaching.

Etch&rinse adhesive system showed higher bond strength than self-etch adhesive system. The antioxidant used in this study didn't show a significant effect on the SBS alone.



**Effect of Endodontic Irrigants on the Microtensile Bond Strength of Different Adhesives**Dikmen, B.<sup>1</sup>, Tarim, B.<sup>2</sup><sup>1</sup>Medipol University, <sup>2</sup>Istanbul University

**Objectives** The aim of this in vitro study was to evaluate the effect of endodontic irrigants on the bond strength of different adhesive systems.

**Methods** 48 extracted third molars were sectioned 3 mm below the occlusal surface and polished with 600 grit silicon carbide papers. After that, teeth were divided into 12 groups, based on the irrigants and adhesives used. In the control groups, the surfaces were irrigated with distilled water for 30 s. In the experimental groups, NaOCl, EDTA+NaOCl and CHX were the irrigants. 5.25% NaOCl was applied for 30 s; 17% EDTA, for 1 min and 2% CHX for 5 min. The resin composites (Z250, 3M ESPE) were then built up to a height of 5 mm using Single Bond (3M ESPE), Clearfil SE Bond (Kuraray Medical) and Xeno 3 (Dentsply) on dentin surfaces of all teeth. After this, each specimen was serially sectioned to obtain sticks with cross sections of 1 mm<sup>2</sup> and the microtensile bond strengths (μTBS) of these sticks were determined. Data were statistically analysed by two-way ANOVA, one-way ANOVA and the Bonferroni test.

**Results** NaOCl significantly reduced μTBS of Single Bond and Clearfil SE Bond ( $p < 0.01$ ). For all adhesive systems, the EDTA+NaOCl-treated groups exhibited significantly lower bond strength than the control groups ( $p < 0.01$ ). The application of CHX had no significant effect on the μTBS of self-etch adhesives (Clearfil SE Bond and Xeno 3) but significantly decreased the bond strength of the total etch adhesive (Single Bond) ( $p < 0.01$ ).

**Conclusions** Different irrigants had several effects on the bonding of different adhesives. While clinically restoring endodontically treated teeth, these impacts should be considered.

The mean microtensile bond strength values and standard deviations of each group

Adhesive	Microtensile Bond Strengths (Mpa)	Microtensile Bond Strengths (Mpa)	Microtensile Bond Strengths (Mpa)	Microtensile Bond Strengths (Mpa)
	Control	NaOCl	EDTA+NaOCl	CHX
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Single Bond	37.21±5.08	18.99±4.31	15.43±3.91	22.02±4.57
Clearfil SE Bond	39.58±5.29	26.92±6.58	22.00±5.92	39.81±4.85
Xeno 3	20.76±5.09	21.16±4.93	16.07±5.10	18.08±4.71

Oneway ANOVA Test \*\*  $p < 0.01$

0259

#### **EFFECT OF PROPOLIS AS A ROOT CANAL IRRIGANT ON BOND STRENGTH TO DENTIN**

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**Objectives** The purpose of this in vitro study was to evaluate the effect of Propolis on bond strength to dentin when used as a final irrigant.

**Methods** One hundred and twenty six human third molars were sectioned 3 mm below the occlusal level and then randomly divided into seven groups (n= 18). The exposed dentin surfaces were treated with irrigation solutions as follows: Group 1: 5.25% NaOCl; Group 2: 5.25% NaOCl followed by 17% EDTA; Group 3: 5.25% NaOCl followed by Tubulicid Plus; Group 4: 5.25% NaOCl followed by MTAD; Group 5: 5.25% NaOCl followed by 20% Propolis; Group 6: 5.25% NaOCl followed by 2% CHX; Group 7: distilled water (control). Irrigated specimens were bonded using Clearfil SE Bond with tygon tubes for microshear bond strength testing. Data was analyzed using a one-way ANOVA and Tukey test.

**Results** Among the tested groups, although the lowest bond strength values were detected in Group 1 ( $11.25 \pm 1.97$ ), a significant statistical difference was detected only between this group and Group 4 ( $18.70 \pm 1.82$ ) and Group 5 ( $16.75 \pm 3.70$ ) ( $p=0.0012$ ).

**Conclusions** 20% propolis solution as a final irrigant was found to have a favorable effect on the dentin bond strength of the tested self-etch adhesive to coronal dentin when compared with other irrigation solutions.

0260

#### **Effect of a hydrogel sealer on tubule occlusion and resin composite adhesion to dentine.**

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**Objectives** To investigate the dentine sealing capacity of an experimental sealer (glutaraldehyde/albumin hydrogel, HDG) applied on citric acid-etched dentine and the shear bond strength (SBS) of resin composite on smear-layer covered dentine in the presence of the sealer.

**Methods** Polished dentin disks prepared from 3rd molars were randomly assigned into four groups (A-D, n=3 each) with the following treatments: Group A: smear-layer; Group B: citric acid-etched (6%, 60s, simulation of eroded dentine); Group C: B+HDG and D:B+CLT (Calm-it, glutaraldehyde-HEMA/Dentsply). After water storage (37°C/24h), specimens (top surfaces/cleaved interfaces) were examined by reflected-light microscopy and ESEM. Polished dentine specimens (n=2X10) were treated with HDG or CLT, then a universal adhesive layer (Prime&Bond Elect/Dentsply) was applied and finally restored with a flowable composite (SDR/Dentsply, Ø:2.38mm,h:2mm) in a single-layer and light-cured for 30s. After water storage (1w/37°C) all specimens were debonded under shear loading. Statistical analysis was performed by t-test (SBS) and X2 (failure mode) at an  $\alpha=0.05$ .

**Results** Following CLT treatment, the dentine surfaces were covered by a thin sealer layer, with opened tubule orifices. Treatment with HDG showed formation of a homogeneous, solid layer, completely sealing tubule orifices and intertubular dentine. The layer was elastic in tactile probing and strongly attached to the substrate. The results of SBS were (mean, sd): CLT: 24.6(3.2) MPa; HDG: 12.5(2.0) MPa. Although more adhesive type dentin-sealer failures were observed in HDG, no statistically significant differences were found in the failure mode.

**Conclusions** The experimental sealer demonstrated superior sealing capacity of exposed dentine in comparison with CLT, but significantly lower SBS.

0261

**The Effect of Antioxidant Agents on Adhesion of Resin Based Sealers to NaOCl-Treated Root Dentin**

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**Objectives** Objective(s): The use of NaOCl as an endodontic irrigant lowers the bond strength of resin cements but this can be reversed by the use of antioxidant agents. The aim of this study was to evaluate the effect of antioxidant agents in improving the bond strength of a resin based sealer to NaOCl-treated root dentin.

**Methods** Method(s): Thirty two freshly extracted single-rooted human mandibular premolars were used in this study. The root canals were shaped using a reciprocating file system (Dentsply-Maillefer, Switzerland) and irrigated with distilled water during procedure. Four groups of 8 samples each were conditioned with one of the following irrigation regimens: (1) 5% NaOCl for 10 min and then 17% EDTA for 1 min; (2), 5% NaOCl for 10 min followed by 30% grape seed extract for 10 min and then 17% EDTA for 1 min; (3) 5% NaOCl for 10 min followed by 10% ascorbic acid for 10 min and 17% EDTA for 1 min; (4) distilled water for 10 min (control). The canals were irrigated with 10 mL distilled water between each irrigant to prevent interaction of solutions. After irrigation procedures, all root canals were dried with paper points and then filled with MM Seal sealer (MICRO-MEGA, France). The samples were stored in incubator for 7 days. Then cross-sectioned into 6 slabs (two slabs from each apical, middle, coronal third), 1 mm thick, that were trimmed and tested for push-out bond strength in a universal testing machine. The values were analyzed by one-way analysis of variance and Tukey post hoc tests ( $P < .05$ ).

**Results** Result(s): There were statistically significant differences among all the groups except Groups 1 and 4. Group 2 was showed the highest bond strength values from other groups ( $p=0.00$ ).

**Conclusions** Conclusion(s): Grape seed extract and ascorbic acid can be used to reverse negative effects of NaOCl as an alternative conventional irrigation.

0262

**Effect of Er:YAG laser on bond strength of self-adhesive cement**

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<sup>1</sup>Yeditepe University;Faculty of Dentistry, <sup>2</sup>Yeditepe University;Faculty of Dentistry

**Objectives** The aim of this study was to evaluate the microtensile bond strength ( $\mu$ TBS) of a self-adhesive resin cement after different conditioning techniques to dentin.

**Methods** Occlusal enamel of 15 human third molars were removed with 180-grit silicon carbide paper (SiC) and smear layer on mid-coronal dentin was standardized with 600-grit SiC. Teeth were randomly divided into 3 groups according to the conditioning techniques: (Control [no treatment], Acid etching [15 sec], Er:YAG laser [100 mJ ;10Hz]). In each group composite onlays (Filtek Z250; 3MESPE) were luted with the self-adhesive resin cement (RelyX Unicem; 3MESPE). After the specimens were stored in distilled water for 24 hours, the  $\mu$ TBS was performed using a universal testing machine (Instron). Data were analyzed using one-way ANOVA and post hoc multiple comparison Tukey's tests ( $p<0.05$ ).

**Results** MPa  $\pm$  SD: Control =  $22.97 \pm 2.70$ , Acid etch =  $19.96 \pm 4.65$ , Er:YAG laser =  $14.45 \pm 2.74$ .  $\mu$ TBS values of Er:YAG laser group were significantly lower than the Acid etch and Control groups, while the difference between Acid etch and Control groups were significant, showing higher values for the Control group ( $p<0.05$ ).

**Conclusions** Conditioning with Er:YAG laser or Acid etching did not significantly improved the bonding of RelyX Unicem to dentin. Self-adhesive approach was found the most effective method.

**0263**

**Evaluation of shear bond strength of adhesives on bioactive cements**

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**Objectives** The aim of this study was to evaluate the shear bond strength (SBS) of one two-step self-etch (Clearfil SE Bond; Kuraray) and one one-step self-etch (Genial bond Bond; GC Co) adhesive systems on one light-cured resin-modified calcium silicate based (Theracal; Bisco) and one calcium silicate based (Biodentine; Septodont) bioactive cements.

**Methods** Forty mold 2mm high and 3mm diameter were prepared using self-cured acrylic resin. Twenty specimen were prepared with Theracal and twenty specimen were prepared with Biodentine cement. Surface of samples were standardized with microscope lam glass at setting reaction. The specimens were randomly divided into 4 groups (n=10). Group I: Theracal-Clearfil SE Bond, Group II: Theracal-Genial Bond, Group III: Biodentine-Clearfil SE Bond, Group IV: Biodentine-Genial Bond. Composite built-ups were performed with Z250 (3M-ESPE) 3 mm in diameter and 5 mm in thickness using teflon molds. After storage in 37 °C for 24 hours, shear bond test was evaluated with an Universal testing machine (Instron). Obtained data were analyzed in two-way ANOVA test and Student-t Test.

**Results** Mean shear bond strength values (MPa)±std were in Group I (5,96±1,89), Group II (11,39±2,45), Group III (6,76±3,66), Group IV (0,81±1,28). SBS values of Group II were higher significantly Group I (p<0.001) and Group IV (p<0.002). SBS values between Group I and Group III were not significantly differences (p>0.05).

**Conclusions** Adhesive bond of adhesive systems to calcium silicate based bioactive cements is possible. And bond strength is silicate based cement depended more than adhesive system.

**0264**

**Influence of Cleaning Protocols on Bond Strength of RelyX™ Unicem 2 to Saliva Contaminated Restoration Materials**

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<sup>1</sup>3M ESPE, <sup>2</sup>R&D

**Objectives** Analyse cement bond strength to restoration materials after saliva contamination and different cleaning protocols.

**Methods** Materials tested were Lava™ Plus (3M ESPE), Empress® CAD and IPS e.max® CAD (Ivoclar Vivadent). Discs of the restoration materials were pretreated according to manufacturers' instructions and divided into 10 groups (n=6): no saliva contamination (control). Remaining discs were contaminated with human saliva and submitted to different cleaning protocols: no additional cleaning, cleaning with water spray; cleaning with NaOCl 5,4% and cleaning with Ivoclean both followed by rinsing with water. Stainless steel rods (4mm diameter) were cemented onto the restoration specimen under standardized pressure (20g/mm<sup>2</sup>) using RelyX™ Unicem 2 (lightcure) according to manufacturer's instructions. Specimen were stored for 24h (36°C, 100% relative humidity) or artificially aged (5.000 thermal cycles (TC), 5°C - 55°C, 30sec). Shear bond strength (SBS) was measured (Zwick Z010, crosshead speed: 0.75mm/min).

**Data analysis** using MultipleRangeTest (Fisher's LSD; p<0.05).

**Results** see table. Values (MPa) within one table marked with the same superscript characters are not statistically different.

**Conclusions** Overall RelyX™ Unicem 2 self adhesive resin cement shows best bond strength results after saliva contamination if cleaned with NaOCl 5,4 % before rinsing with water.

0265

**Effect of Different Adhesive Strategies on the Shear Bond Strength of Composite Resin to Glass Ionomer Cements**

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Atatürk University

**Objectives** Adequate bond strength between glass ionomer cements and composite resin is necessary for the success of the sandwich technique. The aim of this study was to evaluate the shear bond strength of composite resin to glass-ionomer cements using a universal adhesive under different strategies and to compare with the conventional bonding systems

**Methods** Sixty four samples at 2mm thickness, 4mm diameter of glass ionomer cements (Fuji IX, GC Corp., Japan, Equia GC Corp., Japan) were prepared and divided into four groups according to the adhesive strategies (n=8). Group A : Single Bond (3M ESPE, St Paul, USA), Group B: Clearfil S<sup>3</sup> Bond (Kuraray Medical Inc., Okayama, Japan), Group C: Etch +Universal Bond (3M ESPE, Neuss, Germany) , Group D : Universal Bond. A cylinder of universal nanohybrid composite resin (Voco, GmbH, Germany) at 2mm thickness, 4mm diameter was placed on each sample and light cured. After 24 hours of water storage the specimens were subjected to shear bond strength tests (0,5 mm/min). The statistical analysis was performed with one-way ANOVA and post hoc Tukey tests ( $\alpha=0,05$ ).

**Results** There were no significant differences between Fuji IX group and Equia group when compared with the group treated with the same procedure ( $p>0,05$ ). The highest mean shear bond strengths was observed at Fuji IX+Universal Bond group ( $20.80\pm7.85\text{MPa}$ ) and the lowest mean was observed at Equia+Single Bond group ( $5.34\pm2.63\text{MPa}$ ) ( $p<0.05$ ).

**Conclusions** The bond strength of resin composite to glass ionomer cement can be enhanced when a universal adhesive used.

0266

**Stress analysis in porcelain laminate veneers produced with different preparation techniques and using different luting materials**

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**Objectives** The aim of this study is to evaluate biomechanical behavior of porcelain laminate veneer (PLV) restoration of the maxillary central incisor with different incisal preparations; butt joint and palatal chamfer, luted with adhesive cement that has two different elastic modulus compared with sound tooth by using the finite element method.

**Methods** 3-dimensional models of sound and prepared maxillary central teeth were obtained from micro computed tomography device to be used in finite element analysis. PLV restorations that consisted of laminate veneer, luting resin cement and adhesive were created using SolidWorks CAD program. Then models were input into the Abaqus software to do finite element analysis. A structural linear static analyses was performed to evaluate the effect of stress distribution on mathematical models under the loads of 50 N applied at 60° angle along the tooth's longitudinal axis.

**Results** PLV with butt joint preparation design showed higher stress values than laminate veneer restoration with palatal chamfer design regardless the elasticity modulus of the cement that has been used. Difference between luting resin cements effected teeth with butt joint preparation design more than teeth with palatal chamfer design.

Mathematical models that were assumed to be prepared with butt joint design and palatal chamfer design and luted with different elasticity cements, showed higher stress values than sound tooth according to the load regarding.

**Conclusions** The butt joint and palatal chamfer design PLV restorations demonstrated different mechanical behaviors with regard to different luting material compared the sound tooth. The increase in the elasticity modulus of luting resin cements made stress values higher.

0269

**Impact of Removal Partial Dentures on the oral tissues: A systematic review**

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**Objectives** The placement of a removable partial denture [RPDs] in the oral cavity would appear to affect both the quality and quantity of the bacteria by increasing the accumulation of plaque on the remaining teeth in the absence of an established oral hygiene regime by the patient. However it has also been reported that both gingival inflammation and periodontitis can be treated if the patient's plaque control was adequately controlled. The aim of the present study, therefore was to review the published literature in order to identify appropriate studies for inclusion and to verify whether there was any justification to support the hypothesis that the insertion of an RPD into the oral cavity had a deterioration effect on the health of the oral tissues.

**Methods** 554 papers were identified, from searching both electronic databases (e.g., PUBMED) and hand searching of relevant written journals. Seven papers (Randomised Clinical Trials [RCT]) were subsequently accepted for inclusion.

**Results** The results would appear to suggest that there was some evidence to support the hypothesis that RPDs may increase plaque accumulation and gingival inflammation following placement into the oral cavity. The importance of an established prevention program for RPD wearers (including good plaque control and OHI) for the patient either prior to, or during treatment was emphasised by all Investigators.

**Conclusions** One of the problems, when evaluating the study data, was the lack of homogeneity between the included studies (e.g., study design and duration, calibration details, clinical parameters to be evaluated, reporting of dropout rates and treatment intervention). There are therefore, insufficient RCTs to adequately address the impact of RPDs on the oral tissues however, there was some evidence that would suggest that RPDs promoted plaque accumulation and gingival inflammation, as well as increasing the risk of root caries in patients wearing partial dentures.

0272

**The effect of silver nanoparticles (AgNps) on the flexural strength of polymethyl methacrylate acrylic resin**

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**Objectives** Polymethyl methacrylate-PMMA is the principal material of dental prostheses. The reinforcement of denture base material has been a subject of interest to the clinical practice.

Silver nano particles (AgNps) have been added to PMMA because of their antimicrobial properties. But as these nanoparticles additives they can affect the mechanical properties of the final acrylic resin. The purpose of this study was to investigate the effect of AgNps on the flexural strength of PMMA.

**Methods** Acrylic liquid containing 0.05% and 0.2% and the different sizes of 40-50-60 nanometres AgNps was prepared for a commonly used heat polymerized denture base resin. One group without AgNps was used as control group. Groups with and without nanoparticles were subjected to a three-point-bending test for flexural strength. Fractured surfaces were analyzed by scanning electron microscopy. One-way ANOVA and Nemeyni tests were used to identify any statistical differences ( $\alpha=0.05$ ).

**Results** Th control gruop showed the lowest flexural strength. Addition of AgNps to acrylic resin increased its flexural strength but addition of the size of 50 nanometres and 0.05% nano particles was more effective than 0.2%. The scanning electron microscopy results indicated no differences in the control and nanoparticles groups.

**Conclusions** Silver nano particles (AgNps)-polymethyl methacrylate groups performed better than the control group. The results indicated that were not beneficial in the matrix. The effect of AgNps on flexural strength of PMMA depends on several factors including the type of acrylics and the concentrations of nano particles.

0274

#### Evaluation of Microbial Adhesion on Chlorhexidine Gluconate and Fluoride Gel Added Polymethyl Methacrylate

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**Objectives** The purpose of this study was to investigate the *Streptococcus mutans* (*S. mutans*), which is accepted to be infectious agent to polymethyl methacrylate (PMMA) denture base material manufactured by different chlorhexidine gluconate and fluoride gel proportions.

**Methods** Totally 15 disc shaped wax samples (10 mm diameter and 2 mm thickness) were prepared. Cropped glass fibers were kept in sealed tubes for 5 minutes with different proportions of chlorhexidine gluconate and fluoride gel solutions. The mixture was added to the acrylic PMMA resin. Prepared PMMA acrylic resin (Meliodent, Bayer Dental, Germany) samples, polymerized with conventional heat and pressure technique according to manufacturer recommendations and were divided into 5 subgroups (n=3 per group). 1) No solution added group, control group; 2) 1% chlorhexidine gluconate added group; 3) 2% chlorhexidine gluconate added group; 4) 0.61% fluoride gel group and 5) 1.23% fluoride gel group. After all the samples were polished, surface roughness values were measured and samples sterilized by ethylene oxide gas sterilization.

Samples were placed in 24 well cell culture flasks and sterile saliva, and bacteria were added. Specific broth for examined microorganism were, then, transferred in well plates and incubated for the adhesion. The microorganism adhered to the surface of poly methyl methacrylate were detached by sonification procedure and the viability of bacteria were evaluated in specific media measured by spectrophotometer.

**Results** All the chlorhexidine gluconate and fluoride ion groups showed lower bacterial adherence than the control group ( $p<0.05$ ).

**Conclusions** Addition of chlorhexidine gluconate and fluoride gel significantly decreased the bacterial adherence on PMMA acrylic resins' surfaces.

0275

#### IN VITRO COMPARATIVE EVALUATION OF ANTIMICROBIAL PHOTODYNAMIC INACTIVATION OF *Candida albicans*.

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**Objectives** Antimicrobial photodynamic therapy (aPDT) is an alternative treatment to infections based on the use of photosensitisers (PSs) and visible light. Several aPDT protocols have been used against *Candida* without standardization. In the present study, aPDT with blue (400mW;72J/cm<sup>2</sup>;5min) and red (1W;72J/cm<sup>2</sup>;120sec) light emission diodes (LEDs) probes were used to activate different concentrations of toluine blue (TBO), methylene blue (MB) and bengal rose (BR) in association with *Candida albicans*, searching to identify the best protocol for this microorganism.

**Methods** Initially, the minimum inhibitory concentration (MIC) and the minimum fungicidal concentration (MFC) were determined, with values between 88 – 0,687uM, followed by the analysis in planktonic suspension and biofilm formation, with 135 disk-shaped acrylic resin specimens (10 x 2mm). For these tests the following groups were designed: no light or photosensitizer (P-L-); stained and irradiated (P+L+); stained and not irradiated (P+L-); just irradiated (P-L+); sodium hypochlorite 1% (HC) or nistatin 100.000U/ml (NT) controls. Aliquots of the suspensions were diluted after treatment and cultured on Sabouraud agar plates. The number of colony-forming units (CFU) was calculated after 48 h. Data were analyzed by Kruskal-Wallis and Dunn's tests for those who didn't follow the normality, and ANOVA and Tukey's test for the others ( $\alpha=0.05$ ).

**Results** The MIC/MFC results for TBO, MB and BR were, respectively, 5.5/11uM, 22/44uM, 22/22uM. For the planktonic suspension, statistical difference was observed between the groups P+L+ and P-L- ( $p<0.0001$ ) and no difference between NT and P+L+. For the biofilm, all associations showed difference between P+L+ and P-L- ( $p<0.0001$ ). Log reduction values for TBO, MB, BR were respectively: 4.22, 2.28, 1.48. CFU reduction was also observed when the red LED 1W was used alone ( $p<0.0001$ ).

**Conclusions** This study demonstrated that all associations of aPDT exhibited antifungal effects, but TBO with red LED 1W proved to be the best association, effectively reducing 99.9% of yeasts.

0277

# **Influence of Filler Systems on Wear of Resin Teeth Materials**

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**Objectives** To investigate the influence of different filler systems with varying filler concentrations on the linear wear resistance and three-body-wear of experimental resin teeth formulations.

**Methods** Experimental resin teeth formulations (90%MMA, 10%EGDMA) were prepared with three different filler types (A=SILMIKRON1171-900 PST/3, B=SILMIKRON810-10/1 MST/1, C=MICROSPAR1351-900 MST, manufacturer: Quarzwerke, Frechen, D) using 5, 10 and 20 weight% filler and polymerized. Fillers varied in grain size, density, spec. surface, type, shape and silanization. Basic mechanical properties (flexural strength, Vickers hardness, universal hardness, fracture toughness) were determined. For investigating linear contact wear, specimens (n=8/group; diameter=5mm, thickness=2mm) were loaded with steatite antagonists (d=3mm): 120,000 cycles, 250g, H<sub>2</sub>Odest. 25°C, lateral movement=1mm. Vertical substance loss [µm] was determined (3D-laserscanning-microscope, Keyence, J). Three-body-wear tests (6 specimens/group; l=12mm, w=10mm, t=2mm) were performed with food bolus (wear machine, ACTA, Willytec, D): 200,000 cycles, 15N, antagonist wheel: 60U/min, sample wheel: 130U/min. The wear trace was determined (Perthometer-S6P, Perthen-Feinprüf, D) and referenced to wear data of the control (veneering composite Sinfony; 3M Espe, D). As reference unfilled resin was tested. Statistics: ANOVA, Bonferroni-post-hoc, Pearson, α=0.05.

**Results** See Table.

**Conclusions** Contact wear varied significantly (p=0.000), strongly depended on the amount and type of filler but showed no correlation to the mechanical properties. The addition of three different filler systems showed small influence on abrasion.

## **Results**

Mean/std	Flexural strength [MPa]	Vickers hardness [N/mm <sup>2</sup> ]	Fracture toughness K <sub>Ic</sub> [MPam <sup>1/2</sup> ]	Universal hardness [N/mm <sup>2</sup> ]	Contact wear [µm]	Three-body wear [%]
0 control	98/5	170/2	1.40/0.17	146/1	362/52	1.81/0.06
A5	102/5	194/3	1.20/0.07	157/1	241/85	1.76/0.19
A10	79/14	207/1	1.24/0.09	165/1	400/98	1.71/0.11
A20	59/14	241/6	1.17/0.04	190/4	172/27	1.63/0.11
B5	98/4	203/4	1.35/0.08	138/14	138/25	1.69/0.16
B10	84/18	208/1	1.35/0.12	155/6	239/72	1.30/0.01
B20	87/5	233/1	1.31/0.05	171/1	192/54	1.43/0.14
C5	101/4	199/3	1.36/0.06	153/1	272/63	1.68/0.15
C10	92/5	209/1	1.41/0.09	159/0	310/71	1.58/0.10
C20	82/4	227/2	1.28/0.08	166/2	160/42	1.48/0.12

0279

# **Effect of Various Rotary-Systems on Removal of Root-Canal-Filling: CBCT Analysis**

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**Objectives** The aim of this study was to evaluate and compare the efficacy of Twisted File (TF) Adaptive (Axis/SybronEndo, Orange, CA), Reciproc (VDW, Munich, Germany) and Protaper Universal Retreatment System (Dentsply Maillefer, Ballaigues, Switzerland) instruments for removing root canal filling from root canals by using cone beam computed tomography (CBCT).

**Methods** Sixty single rooted teeth were decoronated and instrumented with Protaper Universal instruments to size



F4. Root canals were obturated with gutta-percha and AH-plus by using lateral compaction technique and incubated for 4 weeks. Preoperative CBCT scans were taken under constant settings. The teeth were allocated to four groups (n=15) and retreated with TF Adaptive, Reciproc, Protaper Universal Retreatment or hand files. Teeth were scanned again and percentage volume of residual root canal filling material was established. Total time for retreatment was recorded. Data was statistically analyzed using One way analysis of variance and posthoc Tukey HSD tests. Results All specimens examined displayed root canal filling remnants within root canals. The statistical ranking of residual filling material volume values was as follows: Hand file = TF Adaptive > ProTaper Universal Retreatment = Reciproc. ProTaper Universal Retreatment and Reciproc systems required shorter period of time for retreatment. Conclusions None of the rotary systems used could completely remove the root canal filling material. The Reciproc although not specifically produced for the removal of root canal filling can be strong alternative system for endodontic retreatment procedures. TF Adaptive system was advantageous over hand files regarding operating time.

## 0281

### **Cyclic Fatigue Resistance of D-RaCe, ProTaper, and Mtwo Nickel–Titanium Retreatment Instruments after Immersion in Sodium Hypochlorite**

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**Objectives** The aim of this study was to investigate the effect of immersion in sodium hypochlorite (NaOCl) on cyclic fatigue resistance of three different rotary nickel-titanium (NiTi) retreatment files.

**Methods** A total of 90 new ProTaper, D-RaCe, and Mtwo retreatment files were tested. Thirty files of the same brand were randomly assigned to two groups (n = 15). Group 1 was no immersion (control group) and 16 mm of group 2 instruments were immersed in 5% NaOCl at 37 °C for 5 min. All instruments were then tested for cyclic fatigue. Resistance to cyclic fatigue was determined by counting the numbers of cycles to failure in a 60° curve with a 5-mm radius, recording the time in seconds to fracture. Data were analyzed by 2-way analysis of variance.

**Results** Resistance to cyclic fatigue decreased significantly for D-RaCe retreatment files after immersion in NaOCl. ProTaper and Mtwo retreatment files were not affected from immersion to NaOCl. D-RaCe retreatment instruments showed better cyclic fatigue resistance than ProTaper and Mtwo retreatment instruments, and the difference was statistically significant ( $p < 0.05$ ). There was no significant difference between ProTaper and Mtwo retreatment instrument groups ( $p > 0.05$ ).

**Conclusions** D-RaCe retreatment instruments had the highest cyclic fatigue resistance among retreatment files tested in this study, but immersion to NaOCl decreased the cyclic fatigue resistance of D-RaCe retreatment instrument.

## 0282

### **Debris removal of various final irrigation regimes from simulated apical root canal irregularities**

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Selcuk University

**Objectives** To investigate the effectiveness of different final irrigation regimes in removing dentinal debris from simulated apical root canal irregularities.

**Methods** Ninety-six extracted human mandibular pre-molar teeth were instrumented with ProTaper rotary files up to size F5. The teeth were then split longitudinally through the canal. A standardized groove prepared into the apical part of the one halves and three hemispherical-shaped cavities were prepared to opposite side of the groove. Each groove and cavities was filled with dentinal debris and root halves were reassembled using wires and sticky wax.

The specimens were irrigated according to the final irrigation regimes: 5.25% NaOCl and 17% EDTA, 5.25% NaOCl and Qmix, 13.8% ClO<sub>2</sub> and 17% EDTA, 13.8% ClO<sub>2</sub> and Qmix, 5.25% NaOCl/PUI and 17% EDTA, 5.25% NaOCl/PUI and Qmix, 13.8% ClO<sub>2</sub>/PUI and 17% EDTA, 13.8% ClO<sub>2</sub>/PUI and Qmix. The amount of remaining debris was evaluated under a stereomicroscope at 30x magnification. The data were analyzed by means of Kruskal-Wallis and Mann-Whitney *U*-test.

**Results** Groups with NaOCl showed superior debris removal effect to groups with ClO<sub>2</sub>, irrespective of passive ultrasonic agitation ( $P < 0.05$ ). No significant difference was found between groups including EDTA and Qmix ( $P > 0.05$ ). There were no significant differences between groups with or without passive ultrasonic irrigation ( $P > 0.05$ ).

**Conclusions** Based on the present findings, irrigation with NaOCl compared with ClO<sub>2</sub> resulted in significantly less debris in simulated apical root canal irregularities. Additional passive ultrasonic irrigation did not improve debris removal efficacy.

0283

**Spectrophotometric Determination of Irrigant Extrusion Using Laser Activated Irrigation and Two Needle Irrigation Techniques in Root Canals of Primary Teeth**

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**Objectives** The aim of this study was to compare the effects of 2 power settings of laser activated irrigation (LAI) with Er,Cr:YSGG laser and 2 different needle tips during irrigation procedure on the amount of apically extruded irrigant in primary maxillary second molar using spectrophotometric method.

**Methods** This experimental *in vitro* study was conducted on left and right mesiobuccal canals of 60 extracted primary maxillary second molar teeth. Cleaning and shaping of the teeth were completed using Twisted File Adaptive instruments (SM 1 and SM 2). Then the roots were covered with two coats of nail polish and a hole was created in the nail varnish that covered the apical foramen using a size 15 K-file. Teeth were irrigated with 2.5% NaOCl by 1 of 4 methods: Group 1: LAI at 1 W, Group 2: LAI at 0.5 W, Group 3: Conventional needle irrigation (CNI) with open-ended needles, and Group 4: CNI with side-vented needles. Extrusion of NaOCl was evaluated using a pH indicator and a spectrophotometer. Standard curves were prepared with known amounts of irrigant to quantify amounts in unknown samples. Data were analyzed statistically using two-way ANOVA test.

**Results** Although the CNI with open-ended needle group resulted in the largest quantity of irrigation solution, the LAI at 0.5 W group was the smallest. However, the difference between the all groups was not statistically significant at the 95 % level of confidence ( $P > 0.05$ ).

**Conclusions** The spectrophotometric method used in this study proved to be very sensitive while providing quantification of the irrigant levels extruded. LAI at 0.5 W and 1 W resulted similar solution extrusion to the CNI technique.

0284

**Comparison of Apically Extruded Debris Following Use of Twisted File Adaptive System with Laser-activated Irrigation and Conventional Needle Irrigation Techniques**

KUSTARCI, A., Tuncay, Ö., ER, K., HARORLI, H.

Akdeniz University

**Objectives** The aim of this study was to evaluate apical extrusion of debris in canals prepared using Twisted File Adaptive (TFA) system using laser-activated irrigation (LAI) with Er,Cr:YSGG laser at 0.5 W and 0.75 W and conventional needle irrigation (CNI) with two different needle tips, open-ended and side-vented.

**Methods** Sixty freshly extracted mandibular premolar teeth were divided into four groups as follows; Group 1: TFA preparation of root canal with LAI at 0.75 W used to provide irrigation, Group 2: TFA preparation with LAI at 0.5 W, Group 3: TFA preparation with open-ended needle, Group 4: TFA preparation with side-vented needle. Debris extruded from the apical foramen during root canal preparation was collected into preweighed Eppendorf tubes. The weight of the dry extruded debris was established by subtracting the preinstrumentation and postinstrumentation weight of the Eppendorf tubes for each group. Data were analyzed using the Kruskal Wallis and Mann Whitney-*U* tests were used to compare groups.

**Results** LAI technique extruded more debris than CNI technique with both needle tips during TFA preparation. There were significant differences between the Group 4 and both Groups 1 and 2 ( $P < 0.05$ ). Also, significant difference was found between the Group 1 and Group 3 ( $P < 0.05$ ). However, there were no statistically significant differences between the other groups ( $P > 0.05$ ).

**Conclusions** Within the limitations of this study, it can be concluded that agitation method such as LAI technique produced more debris extrusion compared with CNI technique.

0285

**Efficacy of Laser Activated Irrigation on Apically Extruded Debris with Different Preparation Systems**  
**KUSTARCI, A., ER, K.**

AKDENIZ UNIVERSITY, FACULTY OF DENTISTRY

**Objectives** The aim of this study was to evaluate apical extrusion of debris in canals prepared with 3 nickel-titanium rotary file systems [Twisted File Adaptive (TFA), Reciproc (RP), and Revo-S (RS)] and 2 irrigation [conventional needle irrigation (CNI) and laser-activated irrigation (LAI)] techniques.

**Methods** Ninety extracted single-rooted human mandibular premolars with straight canals were randomly assigned to 6 groups (n = 15) according to the file and irrigation protocols used: (1) TFA and LAI group; (2) RP and LAI group; (3) RS and LAI group; (4) TFA and CNI group; (5) RP and CNI group; and (6) RS and CNI group. Debris extruded from the apical foramen during root canal preparation was collected into preweighed Eppendorf tubes. The weight of the dry extruded debris was established by subtracting the preinstrumentation and postinstrumentation weight of the Eppendorf tubes for each group. Data were analyzed using the Kruskal Wallis and Mann Whitney-U tests with Bonferroni correction were used to compare groups.

**Results** LAI groups extruded more debris than CNI groups ( $p < 0.05$ ). However, no statistically significant differences were observed among the file groups, when each irrigation method was evaluated separately ( $p > 0.017$ ).

**Conclusions** Within the limitations of this study, it can be concluded that agitation method such as LAI had a significant effect on the amount of extrusion.

0286

**Evaluation of mTAP removal by photon-induced photoacoustic streaming technique**

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**Objectives** The aim of this study was to compare the efficacy of combination of different irrigation activation regimens and photon-induced photoacoustic streaming (PIPS) technique in the removal of modified triple antibiotic paste (mTAP) from root canals.

**Methods** Five-hundred extracted human mandibular-premolars were prepared using ProTaper- Rotary-Files, up to size F4. The root canals were filled with mTAP medicament, and after 4 weeks, the roots were randomly assigned to 7 groups (n=15) according to the irrigation regimens used: Self-Adjusting File (SAF), Passive-Ultrasonic-Irrigation (PUI), EndoActivator (EA), combination of SAF and EA, combination of SAF and PUI, combination of PUI and EA, PIPS. The roots were sectioned and the amount of remaining medicament at 20x magnification using a 4-grade scoring system. The data was evaluated using the Kruskal-Wallis and Mann-Whitney U tests.

**Results** There were statistically significant differences among all experimental groups. The PIPS, SAF, combination of SAF and EA, combination of SAF and PUI showed significantly better performances than PUI and combination of PUI and EA in removing mTAP from the root canal ( $P=0.000$ ).

At the apical and middle third; the PUI and combination of PUI and EA and at coronal third the PUI showed significantly worst performances. ( $P<0.05$ )

**Conclusions** PIPS and SAF were more effective removal of mTAP from root canals than EA, PUI. It is difficult to completely remove antibiotic pastes from root canals.

0288

### **Comparison Of Students' Perceptions On Plastic And Extracted Natural Human Teeth During Preclinical Endodontic Training**

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Yeditepe University Faculty of Dentistry

**Objectives** The aim of this study was to evaluate the general perceptions of 3rd year students on plastic and extracted natural human teeth during their preclinical training program.

**Methods** Two identical questionnaires were distributed to 44 third year dental students who evaluated their perceptions on either plastic or extracted human natural teeth for their preclinical practices. The questionnaires included questions on students' perceptions on various aspects of both types of educational teeth such as ease of cavity preparation, tactile sensitivity, root canal shaping, obturation and hygiene measures. The students were asked to score each question using the Likert's scoring which ranged from 1 to 5. Following the completion of both questionnaires, the scorings were recorded and the results were statistically analyzed using the Wilcoxon signed-rank test. Statistical significance was set at  $p < 0.05$ .

**Results** The results indicated that there was a statistically significant difference in favor of human extracted teeth in terms of hard tissue sensation and access to the pulp chamber ( $p < 0.05$ ). On the other hand, there was a statistically significant difference in favor of plastic teeth in terms of ease of rubber dam application and the provision of a hygienic environment ( $p < 0.05$ ). No significant difference was noted for the other parameters tested.

**Conclusions** Though natural extracted teeth may provide better tactile sensitivity during preclinical training procedures, plastic teeth seem to offer some advantages such as a hygienic environment and better practice of rubber dam application. Because of cross-contamination concerns, there is an increasing trend towards incorporating plastic endodontic teeth in preclinical endodontic practices. It appears that plastic teeth might be good aids in a preclinical setting in case their features and properties are further improved.

0289

### **Revascularization of immature teeth with necrotic pulp using Plasma-Rich in Growth Factor (PRGF) and Platelet Rich in Fibrin (PRF)**

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**Objectives** To evaluate the regeneration effect of PRGF and PRF in teeth with open apices and necrotic pulp.

**Methods** In 10 cases of immature teeth with necrotic pulp within dentinal walls, after access cavity preparation and canal irrigation with copious amount of sodium hypochlorite, triple antibiotic paste inserted into the canals. After three–six weeks, PRGF (in 4 cases) and PRF (in 6 cases) which has been obtained from the patients injected / placed into the canals up to the level of the CEJ and sealed with MTA followed by temporary restorative material. The patients returned for review two weeks later. In case of no pain, swelling, fistula the teeth were sealed with MTA and composite and long term follow up started.

**Results** In the cases treated by PRGF at 24 months follow-up, complete apex closure in two teeth and apical closure and continued increase of dentinal wall thickness in two other cases were evident. In the cases treated by PRF at 6-12 months follow up, complete apical closure and continued increase of dentinal wall thickness in two cases; initiation of apical closure in three other cases and complete healing of big lesion in one case without apical closure were evident.

**Conclusions** Within the limitations of this clinical approach and correlating the success across the treated clinical cases, the regenerative approaches in immature teeth with necrotic pulps mainly address in very thin dentinal walls cases.

0291

### **A New Evaluation Method to Determine Depth Depending Properties of Visible Light Curing Resin Based Composites**

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**Objectives** The aim of the study was to develop a new evaluation method of depth depending properties especially the depth of cure (DoC) of VLC-RBC. The depth at 80% maximum hardness (DoC<sub>0.8HVmax</sub>) is the standard method to determine DoC. However, this method describes only one material property providing no information about other depth depending properties e.g. amount of mass loss or post-reaction enthalpy and their DoC.

**Methods** Vickers hardness (HV), mass loss ( $\Delta m$ ), and post-reaction enthalpy ( $\Delta H_R$ ) were measured using Arabeski

TOP OA2 and Grandio OA2 (Voco, Cuxhaven, Germany). The samples each 0.5 mm thick separated by Mylar-strips were stacked to a 4 mm thickness. Three irradiances (650, 1200 and 2200 mW/cm<sup>2</sup>) and three exposure times (5, 20 and 80s) were used for curing. Before hardness testing and DSC measurements the samples were stored for one week dry in darkness. The mass loss was determined after one week storage in THF. The data was fitted with a hyperbola-tangent function to determine the depth of cure DoC<sub>HV</sub>, DoC<sub>Δm</sub>, and DoC<sub>ΔHR</sub> of the corresponding properties.

**Results** The fit function describes well the depth depended HV, Dm or DH<sub>R</sub>. The DoC<sub>HV</sub> varied between 0.5 mm (5s BluePhaseLow) and 2.5 mm (80s BluePhaseHigh) for Arabesk and 0.8 and 3.5 mm for Grandio, respectively. The DoC<sub>0.8HVmax</sub> approximately exceeds the DoC<sub>HV</sub> of the new evaluation by 0.3 mm for both VLC-RBC. The DoC<sub>Δm</sub> and DoC<sub>ΔHR</sub> show more scatter with respect to the DoC<sub>0.8HVmax</sub> probably due to additional filler loss and variations in filler content.

**Conclusions** The new evaluation method describes quantitatively well the depth depending properties and allows for a more conservative and preciser DoC determination as all data point are included. Furthermore, it indicates that the 0.8 HV<sub>max</sub> standard method overestimates the depth of DoC.

Comparison of the Depth of cure of 80% of maximum hardness (DoC<sub>0.8HVmax</sub>) and the results of the fit functions of hardness (DoC<sub>HV</sub>), mass loss (DoC<sub>Δm</sub>) and post-reaction enthalpy (DoC<sub>ΔHR</sub>)

	DoC <sub>0.8HVmax</sub>	DoC <sub>HV</sub>	DoC <sub>Δm</sub>	DoC <sub>ΔHR</sub>
<b>Arabesk</b>	[mm]	[mm]	[mm]	[mm]
Celalux 2	1.0 (0.1)	0.7 (0.1)	0.5 (0.1)	1.0 (0.0)
	1.7 (0.1)	1.4 (0.1)	1.5 (0.1)	1.0 (0.2)
	2.4 (0.2)	2.0 (0.2)	2.3 (0.1)	1.5 (0.1)
Bluephase 20i Low	0.7 (0.1)	0.5 (0.1)	0.3 (0.1)	-0.1 (0.2)
	1.5 (0.1)	1.2 (0.1)	1.3 (0.1)	0.7 (0.3)
	2.1 (0.1)	1.7 (0.1)	2.1 (0.1)	1.4 (0.1)
Bluephase 20i Turbo	1.6 (0.0)	1.3 (0.0)	1.2 (0.2)	0.9 (0.1)
	2.3 (0.1)	2.0 (0.1)	2.2 (0.1)	1.0 (0.2)
	2.9 (0.2)	2.5(0.2)	3.0 (0.2)	2.0 (0.3)
<b>Grandio</b>				
Celalux 2	1.2 (0.1)	1.0 (0.1)	1.2 (0.0)	
	1.8 (0.1)	1.4 (0.1)	2.1 (0.2)	
	2.9 (0.1)	2.5 (0.0)	2.9 (0.3)	
Bluephase 20i Low	1.1 (0.3)	0.8 (0.4)	1.1 (0.1)	
	1.8 (0.4)	1.5 (0.4)	1.9 (0.2)	
	2.6 (0.3)	2.2 (0.3)	2.8 (0.3)	
Bluephase 20i Turbo	1.8 (0.2)	1.5 (0.3)	2.1 (0.1)	
	2.8 (0.1)	2.5 (0.1)	3.0 (0.1)	
	3.8 (0.0)	3.5 (0.0)	3.9 (0.1)	

0292

### Evaluation of Irradiance of Different Light-polymerizing-units at Different Depths

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#### Objectives Introduction

Different light polymerizing units (lcus) deliver different irradiance. Depending on the depth of the cavity, the amount of irradiance delivered to the material to be cured may vary, affecting the polymerization of this material.

#### Objective

The objective of this study was to quantify the amount the irradiance of different lcus at different distances.

#### Methods Methods

Three different LCUs (1)Elipar S10 (3M ESPE, Seefeld, Germany); (2)Elipar Paradigm DeepCure (3M ESPE) and (3)Bluephase Style (Ivoclar Vivadent, Schaan, Liechtenstein) were used at the standard mode were mounted on a Marc™ Resin Calibrator (BlueLight Analytics Inc., Halifax, NS, Canada) and tested at group 1)0.0mm; group2)3.0mm and group3)5.0mm. The timer in each LCU was set for 10 seconds of exposure following manufacture's recommendation. The amount of irradiance was calculated for all different distances. Measurements were repeated three times for each surface. Means and standard deviations were calculated. Results were analyzed with ANOVA followed by Tukey HSD test ( $\alpha=0.05$ ).

#### Results Results

Means and standard deviations of light transmission ( $\text{mW}/\text{cm}^2$ ) are shown in table 1. There was a statistical significant difference of light transmission through all different thicknesses ( $p<0.05$ ).

#### Conclusions Conclusion

Different LED lcus deliver different irradiance. Special attention should be used in select the correct lcu during polymerization of resin-based materials in deeper preparations.

Means of irradiance ( $\text{mW}/\text{cm}^2$ ).

	Elipar S10	Elipar DeepCure	Bluephase Style
0.0mm	1901.58	2227.04	1265.27
3.0mm	1627.29	1768.09	1200.53
5.0mm	1292.13	1450.61	1137.50

0293

### Effect of Flowable Composite Resin Materials Induced by Light Emitting Diode (LED) Curing Unit through Ceramic Material

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**Objectives** The aim of this study was to evaluate the microhardness of light cured flowable resin composites (Estelite Flow Quick High Flow, Tokuyama Dental, Japan - Charisma Opal Flow, Heraeus Kulzer, Germany - Filtek Ultimate Flowable, 3M ESPE, USA - Beautifil Flow Plus, Shofu Inc., Japan - Estelite Flow Quick, Tokuyama Dental, Japan) through ceramic material.

**Methods** The materials were prepared with circular molds with 2mm depth and 5mm diameter and cured with LED (Bluephase LED light-curing unit, Ivoclar Vivadent, Liechtenstein) for 20 seconds directly or through 1 mm thick ceramic material. All samples were stored in incubator for 24 hours. After 24 hours the upper and the lower surfaces of the samples were measured using a Vickers hardness tester under 100 g load with a dwell time of 10 seconds. 5 measurements were performed from each samples upper and lower surface and recorded as the hardness value.

**Results** Statistical analyses was performed using one way analyses of variance (ANOVA) and the Tukey test at a  $p=0.05$  significance level. At directly cured groups, the upper surfaces of the specimens showed higher hardness values than the lower surfaces of the specimens. However, no statistically significant difference was observed between Beautifil Flow Plus and Filtek Ultimate Flowable groups at upper and lower surfaces. At groups cured under 1mm ceramic material, there was significant difference between upper and lower surfaces for all groups.

When comparing directly and under 1 mm ceramic material groups, there was no significant difference at the upper surfaces of all groups ( $p>0.05$ ). However, at lower surfaces all groups showed significant differences ( $p<0.05$ )

**Conclusions** Light irradiation through 1mm ceramic material for 20 sec. was not enough for complete polymerization of tested flowable composite material at lower surface of the specimens.

0294

**Light Transmission Through Anterior Teeth Using Different Light-polymerizing-units *in vivo***

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University of the State of Rio de Janeiro

**Objectives Introduction**

With the increase of minimal-invasive aesthetic procedures in anterior teeth, the development of alternatives to safely cure resin-based cements have been proposed. Light polymerization of veneers from the lingual surface is an example of procedures that have been advocated.

**Objective**

The objective of this study was to compare the light transmission of two different light-emitting diode (LED) polymerizing unit (LCU) through anterior teeth *in vivo*.

**Methods Methods**

The study protocol was submitted and approved by the Internal Review Board (IRB). Ten dental undergraduate students from the University of the State of Rio de Janeiro (UERJ) volunteered for the study. The study protocol was explained and all participants signed an informed consent before testing. The right maxillary central incisor was used as the measuring tooth for all participants. Measurements were performed at the center of the buccal surface and a single operator examined all participants. Light transmission was measured using a custom-made spectrophotometer fabricated by BlueLight Analytics™ (BlueLight Analytics, Halifax, Canada) to enable measurements *in vivo*. Three different LCUs (1)Elipar S10 (3M ESPE, Seefeld, Germany); (2)Elipar Paradigm DeepCure (3M ESPE) and (3)Bluephase Style (Ivoclar Vivadent, Schaan, Liechtenstein) were used at the standard mode. All LCUs were placed at the center of the tooth on the palatal aspect. Bluephase style was always used in the same position. The amount of light transmitted was tabulated and expressed in percentage of total irradiance of the LCU used.

**Results Results**

The lcu tip irradiance for the different lcus was (1)1900mW/cm<sup>2</sup>; (2)2200mW/cm<sup>2</sup> and (3)1450mW/cm<sup>2</sup>. Light transmission through the central incisor had a mean percentage of (1)1.52±0.36%; (2)3.30±1.81 and (3)3.68±1.60%.

**Conclusions Conclusion**

Very little light was transmitted through all central incisors tested. Light-cured only composite resin cements should be used very carefully to avoid problems with the adhesive cementation of restorations in anterior teeth.

0295

**LED curing devices - temperature distribution on natural teeth correlated to intensity and distance.**

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**Objectives Objectives:** Photopolymerization dominates curing of polymer resin-based materials (e.g. composites). The new generation of LED curing devices with higher energy output have brought forward the issue concerning increased temperature and risk of pulp and tissue damage in patients. The aim of the present study was to set up an *in vitro* model to investigate the temperature distribution of natural teeth when subjected to light curing. The hypothesis stated was that heat development would be correlated with irradiance of the devices used as well as on the time of curing and the distance from the curing tip.

**Methods Material and methods:**

Three different LED curing devices (Ivoclar/Vivadent, AG, Liechtenstein) were tested. The irradiance for all devices was carefully controlled (MARC Resin Calibrator, BlueLight Analytics™, Halifax, Canada). Single natural teeth were mounted in a specially designed holder suspended in a thermostatically controlled circulating water bath (36,8±0,2°C) with the root of the tooth immersed under water. Pulp chamber temperature (Tp) was measured by a calibrated thermocouple inserted under x-ray control. The thickness of the dentin was (1.0 mm±0.2). The surface temperature (Ts) of the tooth was measured by thermography (FLIR ThermocamS65HS high precision thermal camera with a macro lens). Temperature measurements were carried out prior to and at 10, 20 or 30 seconds during irradiation and at varying distances perpendicular to the occlusion surface (0, 2 and 4 mm respectively)

**Results Results:**

The heat increase at Ts and Tp were significantly correlated to curing time, distance and irradiance. The highest irradiance (1471±64,9 mW/cm<sup>2</sup>) gave a Ts of 53.1±0.3°C and a Tp of 37,8±0.05°C (30 sec curing/0 mm distance).

**Conclusions Conclusions**

The risk of superficial tissue damage should be seriously taken into account. The method developed showed high validity and repeatability

0296

# **Influence of light curing unit design on energy delivery performance of inexperienced operators**

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Institute of Dentistry

**Objectives** To measure energy delivered to simulated anterior and posterior cavity preparations using four different curing lights by dental students.

**Methods** A light curing simulator MARC (BlueLight, NS, Canada) was used for the collection of data. 20 dental students were asked to position a mannequin head, as they would for a patient, and then to expose the simulated Class I maxillary second molar preparation (sensor 4 mm from light curing unit) and a maxillary anterior Class 3 preparation (sensor 1 mm from light curing unit) for 10 seconds. Mouth opening was fixed at 43mm at the incisors. The energy density ( $J/cm^2$ ) delivered to the preparation was recorded in real-time. The lights used were: Mini LED (Satelec), Bluephase G2 (Ivoclar Vivadent), VALO Cordless (Ultradent), and Elipar S10 (3M ESPE). After the first curing cycle, operators were instructed to use protective blue blocker shield, directly observe the procedure, stabilize the light at a correct distance and correct angle. Then a second light curing cycle was started using the same curing lights. Pre- and Post-instruction energy density values were compared using a 1-way ANOVA ( $\alpha=0.05$ ).

**Results** Energy density delivery significantly ( $p<0.05$ ) increased by up to 23% (Elipar S10 anterior) as a result of short instruction. The amount of energy delivered varied from 5,4 to 12,85  $J/cm^2$  before the instruction and 6,1 to 15,88  $J/cm^2$  after the instruction. On average, the time needed to deliver 16  $J/cm^2$  varied from 10 to 29 seconds for Elipar S10 and Mini LED respectively. For certain light curing units, changing the light curing unit resulted in minimal change in the energy delivered. The improvement observed after instruction was more than the improvement obtained using a generally better performing curing unit.

**Conclusions** Proper light curing technique is more important than choosing a better light curing unit for inexperienced operators.

0297

# **The Effect of Desensitizers on Microleakage of Class V Resin Composite Restorations**

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**Objectives** The aim of this in vitro study was to evaluate the effect of desensitizer application on the microleakage of composite resins.

**Methods** Class V cavities were prepared on the buccal surfaces of fifty extracted human third molars. 50 box-shaped cavities were divided into 5 groups, based on the desensitizers used ( $n=10$ ). All teeth were restored with the same bonding agent and composite material. In the control group, no desensitizer was applied. In the experimental groups, Bisblock, Gluma, Duraphat and bonding agent (Single Bond Universal) were the desensitizers. Desensitizers were applied after composite restorations according to the manufacturer's instructions. All specimens were thermocycled, immersed in 0.5 % basic fuchsin dye for 24 hours, sectioned into two equal halves, evaluated for microleakage using stereomicroscope at a x 30 magnification and scored on a scale of 0-3. Data were analyzed using Kruskal- Wallis tests at the significance level of 0.05.

**Results** There were no significant differences by post treatment with desensitizers on microleakage of composite resin restorations. However, based on the numerical values in our study, duraphat group showed lower microleakage at the occlusal margin, bisblock and bonding group showed lower microleakage at the gingival margin than control group.

**Conclusions** The application of desensitizers as a post treatment option could be considered as an advisable procedure in order to minimize microleakage.

microleakage values

	Group	N	Median	Minimum	Maximum	p
Occlusal	control	10	1	0	2	0,771
Occlusal	bonding	10	0,5	0	2	0,771
Occlusal	gluma	10	1	0	3	0,771
Occlusal	bisblock	10	1	0	1	0,771



Occlusal	duraphat	10	0	0	2	0,771
Gingival	control	10	1	0	3	0,582
Gingival	bonding	10	1	0	2	0,582
Gingival	gluma	10	1	0	3	0,582
Gingival	bisblock	10	1	0	2	0,582
Gingival	duraphat	10	1	0	3	0,582

0298

**The influence of dental operating microscope on the microlakage of composite resin and glass carbomer restorations, an in vitro study**

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**Objectives** To compare the microlakage of composite resin and glass carbomer restorations and to evaluate the influence of using a dental operating microscope in the preparation of class V restorations.

**Methods** 14 extracted human premolar teeth were randomly assigned to two groups. Standardized class V cavities were prepared on the buccal surfaces using a dental operating microscope (OPMI pico, Carl Zeiss) and 14 cavities on the lingual surfaces were prepared conventionally in each group. After the preparation of cavities, each group of teeth were divided in two subgroups. Group MZ: 7 restorations completed under microscope, using Clearfil SE Bond and Filtek Z250 as the restorative material. Group Z: 7 restorations completed with conventional method using the same materials as group MZ. Group MG: 7 restorations completed under microscope, using glass carbomer cement (GCP Glass Fill) with surface coating. Grup G: 7 restorations completed with conventional method using the same materials as group MG. 24 hours after the curing of materials all specimens were subjected to thermocycling ( $5 \pm 2^\circ\text{C}$ - $55 \pm 2^\circ\text{C}$ , dwell time 20 s, 1000 $\times$ ). Specimens were immersed in 0.5% basic fuchsin for 24 h, sectioned and evaluated for dye penetration under stereomicroscope. The statistical analysis were carried out using chi-square test ( $p < 0.05$ ).

**Results** The differences between the occlusal microleakage scores between the groups were found statistically significant ( $p = 0.009$ ). The number of samples scored as no microleakage in group MZ 4 (%57.14) were significantly higher than groups MG and G 0 (%0) ( $p = 0.026$ ,  $p = 0.03$ ). Also, no microleakage score samples obtained in group Z 5 (%7.43) were found significantly higher than groups MG and G 0 (%0) ( $p = 0.007$ ,  $p = 0.006$ ). The differences between the gingival microleakage scores were not found statistically significant ( $p > 0.05$ ).

**Conclusions** Composite resin material showed significantly less occlusal microleakage than glass carbomer regardless of dental operating microscope utilization.

0299

**Evaluation of Microleakage in Class II Restorations with Flowable Composite and Fibers**

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**Objectives** To compare and evaluate the effects of glass and polyethylene fibers with flowable composite and placement techniques on the microleakage in Class II cavities.

**Methods** Class II slot cavities (randomized on mesial or distal surfaces, 4 mm width, 5 mm high, 2mm depth) were prepared on 60 sound nonerupted human third molars. The cavities were bonded with Scotchbond MP etch-and-rinse adhesive (3M ESPE) and were randomly divided into 6 groups (n=10) according to the placement techniques: horizontal, oblique and 2 types of fibers: Glass Fiber (GF) (Ever Stick, StickTech), Polyethylene Fiber (PF) (Ribbon, Ribbond-THM). Filtek Ultimate Flow (FC) and Filtek Ultimate Universal nanohybrid composite (3M ESPE) were used to restore all cavities. In all groups cavities were lined with FC 1mm at the gingival seats as first increment. Groups 1 and 4: FC, Groups 2 and 5: GF inserted in to FC, Groups 3 and 6: PF inserted in to FC. For the placement techniques horizontal placement technique was used in the first 3 groups, oblique placement technique was used in the last 3 groups. The specimens were thermocycled (500 $\times$ ) and immersed in 50% silver nitrate solution for 24 hours. Microleakage on the gingival walls were evaluated with a stereomicroscope and calculated in the form of area after the application of decalcification and clearing method. Data were analyzed with Kruskal-Wallis and Mann-Whitney U-test ( $p < 0.001$ ).

Results There were no significant differences between the placement techniques but less microleakage scores were determined by using oblique placement technique. The significant fewer microleakage scores were determined at the gingival seats in the groups which fibers inserted in to flowable composite were applied.

Conclusions Microleakage was observed in all groups. Oblique placement technique may be used more secure. The usage of fibers combined with flowable composite were reduced microleakage.

#### Mean & SD of Microleakage Values

Groups	n	Mean Values $\pm$ SD
Group 1 H/FC	10	5.58 $\pm$ 0.60
Group 2 H/FC+GF	10	3.08 $\pm$ 0.22
Group 3 H/FC+PF	10	3.78 $\pm$ 0.26
Group 4 O/FC	10	5.48 $\pm$ 0.56
Group 5 O/FC+PF	10	3.00 $\pm$ 0.37
Group 6 O/FC+PF	10	3.78 $\pm$ 0.19
		p < 0.001

#### Inter Group Significance Table

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Group 1	-	S	S	NS	S	S
Group 2	S	-	S	S	NS	S
Group 3	S	S	-	S	S	NS
Group 4	NS	S	S	-	S	S
Group 5	S	NS	S	S	-	S
Group 6	S	S	NS	S	S	-

#### 0300

#### A Comparison Of The Different Self-Adhesive Composites' Microleakage With Using Er-Yag Laser

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Objectives The aim of this study was to evaluate of different self-adhesive composites' microleakage when used different adhesive systems with using Er-YAG Laser on Class V cavities.

Methods 110 non-decayed molar teeth were randomly divided into two groups with using two different preparing methods (bur, Er-YAG laser etching). Class V cavities were prepared for microleakage evaluation. The teeth were randomly divided into two groups, laser etching application was further applied only one group. Cavities were restored as above and then 1000 times thermalcycles was applied on teeth. Teeth were stored in 0.5% basic fuchsin solution and cut for evaluate with stereomicroscope. Friedman, Kruskal-Wallis, One way Anova and Mann-Whitney U and Wilcoxon rank tests were applied (p= 0.05) to have statistics of the obtained data.

Results Generally, in microleakage evaluation between composites, statistically differences were occurred (p < 0.05) on the other hand there was no difference between the methods of cavity preparation (p > 0.05). According to the results of microleakage, laser etching applications had no effect on microleakage and the self-adhesive composites when used alone, can not prevent microleakage. All of the self-adhesive composites showed similar microleakage values (p > 0.05), traditional flowable composite showed lower microleakage values than self adhesive composites (p > 0.05).

Conclusions Self-adhesive composites, showed more microleakage than the control groups and groups which self-adhesive composites applied with adhesive systems. According to the results of this study, self-adhesive composites' application solitary is not recommended.

0301

**The evaluation of effectiveness of adhesive systems in restorative treatments on dental amalgam restorations**  
**Ünal, M.<sup>1</sup>, Atakul, F.<sup>2</sup>**

<sup>1</sup>Afyon Kocatepe University, <sup>2</sup>Dicle University

**Objectives** The aim of this in vitro study was to evaluate the effect on the microleakage of using adhesive systems on preventive restorative treatments with amalgam

**Methods** In this study 100 caries-free human permanent molar teeth extracted because of orthodontic or surgery reasons were used. Teeth were randomly assigned to five groups (n=20) and standardized class I cavities. Then the teeth were randomly divided into five groups (n=20). First group is control which is no adhesive system applied under amalgam restoration (Tytin, Kerr, California, USA). Amalgam Liner (VOCO GmbH, Cuxhaven, Germany) Group II, Clearfil SE-Bond (Kuraray Europe GmbH, Frankfurt, Germany) Group III, Panavia F 2.0 (Kuraray Europe GmbH, Frankfurt, Germany) Group IV, Amalgambond Plus (Parkell Inc., Edgewood, NY, USA) Group V were applied to prepared cavities, amalgam restorations were placed, according to manufacturers' recommendations. Teeth were immersed into distilled water at 37 °C (Nüve Incubator EN 120, Ankara, Türkiye) for 24 h. After 24 h polishing and finishing of restorations were done with polishing tires were under water cooling. After polishing process, samples were subjected to 1000 times thermal cycles. Following this, all teeth, except 1mm surrounding of the restorations, were coated twice with acid resistant varnish and stained with 0.5 % basic fuchsin at 37 °C (Nüve Incubator EN 120, Ankara, Türkiye) for 24 h. Then teeth were sectioned bucco-palatally/lingually and, microleakage scores of occlusal walls were evaluated with a standardized scale from 0 to 4 under stereomicroscope at 15X magnification. And also SEM LEO EVO 40 (LEO Ltd., Cambridge, UK) photographs of amalgam-tooth hard tissue interfaces were taken at different magnifications after microleakage assessment. Results of microleakage test were statistically analyzed by Cruskal-Wallis and Mann Whitney-U tests.

**Results** In terms of microleakage among groups, differences were determined significant (p<0.05). Microleakage of control group was determined as the highest, statistically difference was observed between the other groups.

**Conclusions** In our study oral conditions were tried to be simulated by thermocycling. In prepared class I cavities occlusal microleakage of amalgam adhesive systems are effective in preventing but wasn't completely obstruct

0302

**Margin Analysis of Different Restoration Methods for Deep Class-II Cavities**

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**Objectives** Aim of this in vitro study was to compare the proximal marginal quality of direct composite restorations, CAD/CAM ceramic inlays, and composite inlays according to a visual assessment.

**Methods** Sixty standardized class II MOD cavities with two proximal boxes extending 1.5 mm below the cemento enamel junction were prepared in extracted human molars which were placed in modified phantom models (KaVo). The cavities were randomly assigned to three groups (n=20 each).

Cavities in group I were restored with indirect composite inlays (GrandioSO) extraorally fabricated on a silicone model (Die silicone). Cavities in group II were restored with CAD/CAM ceramic inlays (Cerec 3D, IPS Empress CAD) and in group III with incrementally layered direct composite (GrandioSO). All Inlays were luted with a dual-curing resin cement (Bifix QM).

After finishing and polishing, the cervical margins were visually and tactilely evaluated using a dental probe (DA458R): MQ1: perfect margin (score 0), MQ2: overhang/negative step < 1/3 margin length (score 1), MQ3: overhang/ negative step < 2/3 margin length (score 2), MQ4: overhang/ negative step > 2/3 margin length (score 3), MQ5: complete marginal overhang/ negative step (score 4). Kruskal-Wallis-Test and Mann-Whitney-U-Test served for statistical analysis (p < 0.05).

**Results** The sum score (MQ1-MQ5; median, 1<sup>st</sup> and 3<sup>rd</sup> quartile) was 19.5 (14.5-24) for group I, 11.50 (8.25-16) for group II, and 12 (6.25-16) for group III. Results were statistically significant different between group I and group II as well as between group I and group III, but not between group II and III.

**Conclusions** Within the limitation of this study, the results show that CAD/CAM inlays and direct composite restorations provide better cervical marginal quality than the indirect composite inlay system.

0304

# **HISTOLOGICAL EVALUATION OF DIRECT PULP CAPPING WITH NOVEL NANOSTRUCTURAL MATERIALS BASED ON ACTIVE SILICATE CEMENTS ON PULP TISSUE**

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**Objectives** The aim of this study was to examine the effect of the two new nanostructured materials based on active silicate cements on exposed tooth pulp of Vietnamese pigs.

**Methods** The study comprised 30 teeth and two Vietnamese pigs (24 months old). After class V cavity preparation, the pulp on each tooth was exposed using a small round bur. The following materials were applied on pulp exposures: ALBO MPCA-I (10 teeth), and ALBO MPCA-II (10 teeth). In the control group (10 teeth), exposed pulp was covered with ProRoot MTA®(Dentsply Tulsa Dental, Johnson City, TN, USA). All cavities were restored with glass-ionomer cement (GC Fuji VIII, GC Corporation, Tokyo, Japan). After the observation period of 28 days, the animals were sacrificed and prepared for histological analysis. Light microscope was used for the analysis of dentin bridge formation, tissue reorganization and inflammation, and the presence of bacteria in the pulp.

**Results** Nanostructured material ALBO-MPCA I provided complete dentin bridge in 5 teeth, in 3 teeth dentin bridge was incomplete. ALBO MPCA-II showed complete closure of the pulp opening by dentin bridge in 4 samples, while in the same number of teeth it was incomplete. In the control group, 4 teeth showed a complete dentin bridge, whereas in 6 teeth it was incomplete. Inflammation of the pulp was mild to moderate in all groups. Angiogenesis and many odontoblast-like cells, responsible for dentin bridge formation, were observed. Necrosis was not observed in any case, nor were bacteria present in the pulp.

**Conclusions** Histological analysis indicated favourable therapeutic effects the two materials ALBO-MPCA I and ALBO-MPCA II after pulp capping in teeth of Vietnamese pigs. Pulp reaction was similar to that caused by ProRoot MTA®.

0308

# **COMPARISON OF TWO UNIVERSAL COMPOSITES IN POSTERIOR TEETH: PRELIMINARY REPORT**

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**Objectives** The aim of this randomized, prospective clinical study was to compare the clinical performance of a universal light-curing, ultra-fine particle hybrid composite with a new version of this product produced by the same manufacturer in Class 1 and Class 2 lesions over six-months.

**Methods** A total of 80 (13 Class 1 and 67 Class 2) lesions in 40 patients (21 females, 19 males) with ages ranging between 18-38 years ( $23.15 \pm 5.15$ ) were either restored with Charisma or Charisma Classic (Heraeus Kulzer) in combination with an etch and rinse adhesive system (Gluma 2 Bond) under rubber dam isolation by two experienced operators according to the manufacturer's instructions. Two independent examiners, who were blinded to the composites used evaluated the restorations at baseline and at 6 months postrestoration according to the FDI criteria. Bite-wing radiographs and intraoral digital photographs were taken before and after treatment and at 6 months. Impressions were taken of the relevant arches using polyvinyl siloxane material. Epoxy resin replicas were prepared at baseline and 6 months recall for the assessment of wear and marginal adaptation under scanning electron microscopy (SEM). The statistical analyses were carried out with McNemar, Pearson Chi-square and Cochran Q tests ( $p < 0.05$ ).

**Results** After six months, recall rate was 100%. All restorations were rated as score 1 for esthetic, functional and biological properties. There were no significant differences between the groups for any criteria evaluated at six months ( $p < 0.05$ ). SEM evaluations were in accordance with the clinical findings.

**Conclusions** The use of both materials for the restoration of posterior teeth exhibited similar clinically successful performance at six months.

**0309**

**Representation of different stages of dental decay using 3D Volumetric Models**

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**Objectives** With the use of dental simulation units, dental students spend a substantial part of their time in a laboratory setting developing clinical skills. Nowadays computer technology is increasingly used in practical training at universities. The aim of this study was to develop 3D volumetric teeth models simulating different stages of decay in different areas of the tooth.

**Methods** Anterior and posterior mandibular teeth with decay of different stages of progression were selected.

Different areas of decay (pit and fissures, proximal surfaces, root caries) were represented. The teeth were scanned using CBCT. Data processing and 3D reconstruction was done using Matlab (Mathworks, Natick, MA, USA) and display and virtual sectioning of the volumetric models was done using software developed in the Artificial Intelligence and Information Analysis Lab at the Department of Informatics, Aristotle University of Thessaloniki, Greece. An intensity-based thresholding procedure was used in order to segment the tooth from the holder.

Pseudocoloring was applied on the models to show the layers of the tooth and the presence of decay.

**Results** Scanning of the models proved to be challenging. The use of a holder with lower density was necessary in order to create smooth surface models. The development of the 3D models took several stages to give accurate representation of the decayed teeth. 249 slices were generated for each tooth. The generated 3D volumetric models can be freely rotated and sliced in order to reveal information for the tooth interior.

**Conclusions** The results of this study showed that using 3D volumetric teeth models to depict dental decay can enhance the learning experience by assisting the students to understand the presence, progression and clearing of decay. The created models will be incorporated within a haptics enabled virtual reality simulator of dental procedures.

**0310**

**Validating the Spanish version of the DECLEI survey**

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Universitat Internacional de Catalunya

**Objectives** To validate the Spanish version of the English DECLEI survey.

**Methods** 30 volunteer students of Dentistry (10 third- year, 10 fourth- year and 10 fifth- year students) responded to the DECLEI survey on two different dates: First in Spanish and one month later in English. The Pearson correlation test and the Cronbach's  $\alpha$  were used for the statistical analysis.

**Results** Of 30 surveys in both languages given to the students, 30 were answered in Spanish and 23 in English. The Cronbach's  $\alpha$  was calculated using a Pearson Correlation score  $> 0.4$ . The Cronbach's  $\alpha$  showed value 0.6 in Spanish and 0.7 in English. The three groups of questions in the DECLEI survey obtained Cronbach's  $\alpha$  score of between 0.5 and 0.8 for the two languages. The translation obtained a Cronbach's  $\alpha$  of 0.7

**Conclusions** The translation of DECLEI survey had a good score of Cronbach's  $\alpha$  and it could be a tool for analysing dental student's clinical learning environment in Spanish-speaking countries.

0311

**Knowledge About Hiv/Aids: A Survey Among First And Last Year Dental And Medical Students**

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**Objectives** The aim of this study was to evaluate and compare the dental and medical students' knowledge and awareness about HIV/AIDS.

**Methods** This descriptive study comprised of first and last year students of Yeditepe University, Faculty of Dentistry and Medicine. A questionnaire of 54 items was used to assess the students' knowledge and awareness towards HIV/AIDS. Statistical analysis was performed using IBM SPSS Statistics 22 program (IBM SPSS, Turkey).

**Results** The mean age of students were 21.60 years. All of the students gave correct answer about the blood as a body fluids containing HIV virus. However, their knowledge about saliva, breast milk, cerebrospinal fluid and feces were low. The level of knowledge of risk groups for medicine and dental students was high. However, transmission routes were low. The knowledge level of HIV diagnosing tests was also low in first grade students than last year students. Regarding oral manifestations, last year medical students and both first year dental and medical students had less knowledge than last year dental students.

**Conclusions** Lack of the relevant education is obvious among both groups in our study group. The importance of HIV/AIDS as a public health problem all over the world should be emphasized more, and efficacious dental and medical education programs should be prepared.

0313

**Five Year Clinical and Radiographic Results of Implants placed after Sinus Augmentation with Deproteinized Bovine Bone and Platelet Rich Plasma**

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**Objectives** The purpose of the present clinical study was to assess the implant survival in the resorbed maxilla after sinus augmentation with platelet rich plasma (PRP)/deproteinized bovine bone mineral (DBBM) vs. DBBM/collagen membrane.

**Methods** Using a split mouth design, 10 patients, with  $\leq 5$  mm of residual alveolar bone in the vertical direction, were treated with PRP/DBBM or DBBM/collagen membrane. After 8 months, a total of 22 and 21 implants (Osseospeed™, Astra Tech AB, Sweden) were inserted in PRP and non-PRP sites, respectively. Implant success and survival rate, modified plaque and bleeding indices, probing depth and bone level alterations were evaluated. Primary outcome of the study was implant success rate at 1 and 5 years after functioning.

**Results** Only 1 implant was lost before the prosthetic rehabilitation at the PRP side. The remaining 42 implants showed favorable clinical and radiographic findings at 1 and 5 years examination in both groups. There were no statistically significant differences in all evaluated parameters at 1 and 5 years follow-up in both groups ( $p > 0.05$ ). After 5 years of loading no further implants were lost, giving the overall success rate of 83%.

**Conclusions** The present clinical study showed that high implant success and survival rate can be achieved at 1-year and maintained up to five years following DBBM grafting whether or not PRP is used.

0315

**Photocatalytic enhancement of antibacterial effects of TiO<sub>2</sub> and silver modified TiO<sub>2</sub> nanoparticles studied by *in vitro* Streptococcus salivarius model**

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**Objectives** Bacterial colonization and biofilm formation on implanted devices is the reason of the infections of bone around the implant. The aim of this study was to develop a silver-copolymer nanocomposite surface treatment of titanium implants to restrict bacterial adhesion and to investigate these surfaces illuminated with distinct periods.

**Methods** This study used commercially pure (CP4) sand blasted, acid etched (A, control surface) titanium sample discs (Denti® System Ltd., Hungary) 1.5 mm thick and 9 mm in diameter and two different surface modifications. Two copolymer based nanohybrid layers were developed: B) 60 % TiO<sub>2</sub>/ 40 % copolymer and C) 60% AgTiO<sub>2</sub>/ 40 % copolymer ([Ag] = 0,001 m/m%). These disks were incubated for 4 hours with a culture of *Streptococcus salivarius*, which is a first colonizer in titanium dental implant associated infections. The disks were then exposed to

LED light ( $\lambda=405$  nm, General Electric's Hungary) which is used in dental practices-up to different time periods. The antibacterial effect of the photocatalysts in each group was represented by the bacterial survival ratio after 10, 20, 30, 50, 60, 90 minutes illumination, determined by MTT assay and protein assay.

**Results** The number of the attached bacteria on all titanium surfaces was reduced depending of time. 30 minutes illumination on the titanium discs with 0,001% AgTiO<sub>2</sub> surface killed more than 50 % of attached bacteria.

**Conclusions** According to our results the silver nanoparticle-modified titanium surface shows more intense antibacterial effect than the commonTiO<sub>2</sub>. This effect is intensified, if we apply LED- light illumination. The silver nanocomposite-coated titanium can prevent the infection affecting dental implants.

### 0316

#### **Attachment and proliferation of human oral epithelial cells on TiO<sub>2</sub>-Ag nanohybrid coated titanium implant material**

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**Objectives** The failure of dental implants is caused mainly by peri-implant infections resulting in loss of supporting bone. We developed a new nanoscale surface treatment of titanium implant to prevent infections. Our previous studies showed promising antibacterial characteristic of this coating. In this study, we used epithelial cells, to investigate their attachment and proliferation these new surfaces.

**Methods** Commercially pure (CP4) sandblasted, acid etched titanium sample discs (Denti@ System Ltd., Hungary) 1.5 mm thick and 9 mm in diameter were used as control surface (A). Two copolymer based nanohybrid layers were developed: B) 60 % TiO<sub>2</sub>/ 40 % copolymer and C) 60% AgTiO<sub>2</sub>/ 40 % copolymer ([Ag] = 0,001 m/m%). Surfaces were visualized by SEM. *In vitro* attachment (24h) and proliferation (72 and 168 h) of oral epithelial cells were investigated via MTT, alamarBlue and fluorescence microscope.

**Results** SEM revealed significant changes in surface morphology of the nanohybrid layers compared to the control surface. MTT test and alamarBlue showed that epithelial cells were viable on the coated Ti discs. MTT results demonstrated that the attachment (24h) and the proliferation (72h, 168h) of the cells on the Ag containing (C) surfaces were higher (but no significantly) than on the control and copolymer coated samples (A and B). We observed the least amount of cells on the control surface. Our previous measurements by profilometry revealed, that there was considerable variation in the roughness values of the different surfaces.

**Conclusions** Increased amount of oral epithelial cells were observed on the Ag-copolymer coated surface, due to different surface roughness compared with the control surface. The silver containing nanohybrid layer could ensure a potential antibacterial effect which makes it a promising surface coating. Further cell types (fibroblast and osteoblast) will be tested on these surfaces.

### 0317

#### **Buccal volume change in 3D and peri-implant tissue regeneration in the esthetic area**

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**Objectives** to study the buccal peri-implant volume change after tissue augmentation in the aesthetic area of the maxilla

**Methods** nineteen patients (mean age: 22, range: 18-31) with tooth agenesis of the lateral maxillary incisors were consecutively included. A total of 33 implants (Astra Tech™, DENTSPLY, Mölndal, Sweden) were inserted and the buccal alveolar bone deficiency was reconstructed using deproteinized bovine bone, BioOss® and a resorbable collagen membrane BioGide® (Geistlich, Wohlhausen, Switzerland) at the same time. After primary healing, the implant sites with thin gingival biotypes underwent additional soft tissue augmentation using connective tissue grafts from hard palate (test group, n=10). The remaining 23 implant sites were used as controls. Gypsum cast models from all implants sites at baseline (before implant treatment), 1 and 1½-year follow-up were optically scanned (Q700, 3Shape Scanner, Denmark). The 3D volume change of the buccal aspect of implants, one and three millimeter from the marginal periimplant mucosa, was measured. The differences between the test and control group were statistically analyzed by one-way ANOVA.

**Results** one millimeter from the marginal buccal mucosa the tissue volume was increased 1.41 mm (test) and 0.99 mm (control) from baseline to 1 year follow-up (not significant), and increased 1.57 mm (test) and 0.86 mm

(control) from baseline to 1½ year follow-up (not significant). Three millimeters from the buccal marginal mucosa, the tissue volume was increased 1.84 mm (test) and 1.00 mm (control) from baseline to the 1 year follow-up (not significant), and increased 1.97 mm (test) and 0.76 mm (control) between baseline and the 1½ year follow-up (significant difference).

Conclusions after hard and soft tissue augmentation, there was a gain of volume at the buccal aspect of implants. The volume gain was slightly more and it was more stable at sites with both hard and soft tissue grafts than at sites only augmented with hard tissue grafts. However, due to the limited number of observations more studies are needed to confirm the results.

### 0319

#### **Influence of mucosa phenotypes on marginal bone loss surrounding dental implants**

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**Objectives** The purpose of this study is to evaluate the effects of mucosa phenotype on the marginal bone loss surrounding dental implants.

**Methods** Totally 28 patients received 66 implants (Dentsply implants, Astra Tech, Mölndal, Sweden) in the posterior region of the mouth. The implant sites were divided into two groups according to the mucosa phenotype. In the first group implants were surrounded by thin gingival biotype, in the second group implants were surrounded by thick gingival biotype. In all cases, prosthetic loading was performed post-operatively in the third month. The peri-implant mucosa was allowed to recover for 2 weeks after the second surgery. After clinical try-in sessions, the abutments (Dentsply implants, Astra Tech, Mölndal, Sweden) were torqued with 20 Ncm and fixed prosthesis were cemented. Marginal bone level changes evaluated with the digital peri-apical radiographs which are taken at the beginning, 3, 6 and 12 months later from the function of the implants. Modified plaque index, gingival index, bleeding on probing and probing depths are evaluated to determine the periodontal health of the implants. Statistical analysis was performed using Mann-Whitney-U and Wilcoxon test.

**Results** After 1 year of function, marginal bone resorption was found in  $0.42 \pm 0.35$  mm in the thin biotype group and  $0.34 \pm 0.22$  mm in the thick biotype group. There were no statistically significant between the thin and thick biotype group in terms of 3, 6, 12 months marginal bone resorption ( $p < 0.01$ ). In both groups peri-implant soft tissues are found healthy.

**Conclusions** Within the limitations of this study, it can be concluded that although statistically insignificant, lower bone resorption occurred in thick gingival biotype group. Further studies comprising a higher patient population are required to reach more definite conclusions.

### 0320

#### **Two-year outcomes of immediate implant placement into fresh extraction sockets with a newly branded implant (DTI); A retrospective study**

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Private Practice

**Objectives** The aim of this study was to evaluate the performance of DTI implants after placement into fresh extraction sockets immediately.

**Methods** This study was a retrospective study. All implants were placed immediately into extraction sockets; the cases which were related grafting procedures, sinus lifting or more than 1.5 mm distance between socket wall and implant were not included into the study. Implants were placed with the same doctor and the dentures were finished with the same prosthodontist. The delayed loading protocol was used and all implants were loaded after 3-6 months osseointegration. Periapical radiographs were taken in the time of implant placement and at the end of final restoration to compare marginal bone levels.

**Results** Data were available from 73 implants in 43 patients (21 men and 22 women). One or two implants were placed in the majority of patients. Most of implants were placed in the maxilla (68.2%). Cumulative survival rate after 2 years was 97.3%. A 0.18 mm for mesial and 0.22 mm for distal bone level decreases were measured in the end of 2 years.

**Conclusions** DTI implants can achieve favorable outcomes and high survival rates after 2 years in daily dental practice. The survival and success rates were comparable with those achieved in formal controlled clinical trials.



0321

**Peri-implantitis induced by a stainless steel ligature in a beagle dog**

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**Objectives** The purpose of this study was to develop a new method in which a stainless steel ligature (SSL) was used independently for the first time for a peri-implantitis model in beagle dogs.

**Methods** All mandibular premolars were extracted from six beagle dogs. One month later, three Straumann dental implants (3.3 x8mm RN) were placed in each side of the mandible. Three month later, a SSL was placed in a submarginal position to each implant to induce peri-implantitis. The SSLs were not replaced during the whole experiment. The implant probing depth was recorded 3 times: before placing the SSL, immediately after the SSL was removed and finally one month after the SSL was removed. The depth, width and the area of the bone defect around each implant were measured 3 weeks and 12 weeks after ligaturing using an intra oral X-ray. These data were compared with the data from articles that had used a conventional cotton ligature for inducing peri-implantitis in a beagle dog model. These articles had been selected in literature review.

**Results** During the experiment, the SSL did not need replacing whereas the cotton ligatures had to be replaced one to four times. After 3 weeks there was obviously bone loss around implants. After 12 weeks the SSL had induced significantly more bone loss and worked better on vertical bone loss than a cotton ligature did in most of the selected papers.

**Conclusions** Inducing peri-implantitis in the Beagle dogs with SSL was more rapid, more effective and less complicated .

0322

**Comparison of fracture load and chipping behaviour of of all-ceramic implant-supported cantilevered FDPs.**

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**Objectives** Investigation of in-vitro fracture load and chipping behaviour of 3-unit implant-supported cantilevered FDPs manufactured with two different all ceramic systems.

**Methods** Standardized models for cantilevered FDPs replacing the first molar were made. Eight zirconia frameworks implant-supported 3-unit cantilevered FDPs (Straumann standard implant D=4.1mm and solid abutment) were fabricated (Sirona MC XL) from IPS e.max ZirCAD (Ivoclar) and then veneered with milled lithiumdisilicate-ceramic-shells (IPS e.max CAD) using a fusion ceramic (IPS e.max Crystall./Connect) to connect both parts (CAD-On technique). Another eight monolithic FDPs were milled from Cercon ht (Cercon Brain expert, Degudent) using identical stl-geometry files as for the CAD-On FDPs. All the FPDs were cemented with zinc phosphate cement. The specimens underwent 10,000 thermal cycles between 6.5°and 60°C and 1,200,000 chewing cycles with a force magnitude of 100N. All samples were then subsequently loaded until fracture in a universal testing device with an axial load application on the distal aspect of the pontic to simulate the worst case scenarios.

**Results** No failure was observed after artificial aging for all the cantilevered FDPs. During the fracture test in the universal testing device no chipping or fracture of the veneering materials or the ceramics frameworks were observed up to 1,000 N. All samples failed due to decementation of the FPD from the mesial retainer, occurring at 956±156N (min: 729N, max: 1166N) for the CAD-On fabricated FPDs, and at 530±132N (min: 408N, max: 743N) for the monolithic zirconia FDPs. After decementation, no further damage was observed up to a minimum load of 1,000N at which the test was stopped. Regarding decementation force, the two different ceramics systems differed significantly (Mann-Whitney U-test, p<0.001).

**Conclusions** All cantilever FDPs could withstand at least 1,000N on the pontics without any detectable failure of the ceramics. Failure occurred due to decementation at forces above 400 N which should be sufficient for clinical use. However, cement with higher resistance properties could be taken into consideration for this indication.

0323

### **Characterization of the interface between prefabricated dental implant component and cast base metal dental alloys**

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**Objectives** The aim of this study was to compare the metallurgical compatibility of three different representative base metal casting alloys cast on gold and Co-Cr dental implant cast-to components.

**Methods** Three base metal alloys manufactured by Ivoclar (Schaan, Lichtenstein) were cast on both gold and base metal cylinder cast-to abutments provided by Implantium (Dentium, South Korea). Following the casting, specimens were embedded in resin, sectioned longitudinally and polished after which photographs of the specimens were taken for macroscopic analysis. Stereomicroscope was used to compare the surfaces at low magnifications. The microstructures of the adjacent bulk alloys and the interfacial region were evaluated by scanning electron microscopy (SEM). The Vickers hardness for the bulk implant components, the bulk cast alloys, and the interfacial regions were determined. All tests were performed after simulated porcelain-firing heat treatment. One-way-ANOVA followed by Tukey test was used for statistical analysis ( $\alpha=0.05$ ).

**Results** All three base metal alloys cast on gold cylinder presented casting porosities which were more prominent for Ni-Cr based 4 ALL alloy and Pd-Co-Cr based Callisto CP + alloy compared to Co-Cr based IPS d. Sign-30 alloy. Porosities in IPS d. Sign-30 alloy were much less compared to the other two alloys, yet, it was not acceptable for clinical use either. There was a much better metallurgical compatibility between the above mentioned 3 alloys and the base metal cast-to component. Both the cast alloys and the base metal cast-to structures protected their own microstructural features along the interface. Much less porosities were observed for the base metal cast-to cylinder groups compared to the gold cylinder groups. Vickers hardness (mean $\pm$ SD) of alloys was maintained on both sides of the interphase; 318 $\pm$ 17, 378 $\pm$ 21 and 396 $\pm$ 23 for bulk cast alloy, interface and bulk cast-to component, respectively, for Co-Cr cast-to component groups. Since the interphase was all thrown out on the gold cylinder groups, it was not possible to evaluate the hardness for these groups.

**Conclusions** Casting base metal alloys on gold cylinders should be avoided. However, casting base metal alloys on Co-Cr cylinders provided encouraging metallurgical results in addition to the less expensive budget.

0324

### **Thermodynamic effect of diode laser irradiation on titanium surface of implants placed in bone**

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**Objectives** The aim of this study is to assess the increase of temperature, following laser irradiation with 810nm and 980nm diode laser's wavelengths, of an implant, under conditions that more closely replicate those of the human body.

**Methods** A 4x14mm machined surface implant was placed in a porcine rib to replicate the conductivity of heat given by the bone. A peri-implant vertical defect 2mm wide and 2mm deep, to simulate bone resorption, was created and two lateral perforations were drilled on the side of the bone block for access of the thermocouples. Three thermocouples were positioned, coronally, centrally and apically, on the implant surface.

The tip of the laser was kept 3mm away from the implant surface and continuously moved, in an up and down and side to side fashion, inside the defect for 60 seconds.

Initial temperatures were recorded and the change in temperature was monitored until it cooled down to the initial values.

The experiment was repeated, at room temperature and in a 37°C waterbath with the following settings: 0.6W, 0.8W, 1W continuous and 0.6W, 0.8W, 1W pulsed.

An increase of more than 10°C above the body temperature is considered to cause injury in bone and to compromise regeneration.

**Results** From the analysis of the results it seems that a critical increase of temperature of more than 10°C is reached with 810nm laser at 0.8W and 1W in continuous and 980nm laser at 0.6W, 0.8W, 1W in continuous and 1W in pulsed. No critical increase of temperature was registered with other settings and when the bone block was placed in a 37°C waterbath.

**Conclusions** The results of this study suggest that the use of these diode lasers does not cause a harmful increase in temperature when used under conditions similar to those of the human body.

0326

**Enhanced bone healing around nanohydroxyapatite-coated polyetheretherketone (PEEK) implants: an experimental study in rabbit bone**

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Odontology

**Objectives** The objective of the study was to investigate the bone response in vivo to threaded Polyetheretherketone (PEEK) implants coated with nanocrystalline hydroxyapatite (nanoHA).

**Methods** A total of 24 PEEK implants were coated with nanocrystalline hydroxyapatite and 24 uncoated implants were used as controls. The implant surface was characterized by optical interferometry and scanning electron microscope (SEM).

The implants were inserted in the tibia and femur of 12 rabbits. After 3 and 12 weeks of healing time histological evaluation was preformed.

**Results** There were no differences in bone area (BA) and bone-to-implant contact (BIC) between the groups after 3 weeks. However, after 12 weeks of healing there was a higher BIC for the test implants.

**Conclusions** Our findings demonstrate that implants with a threaded design render good stability to PEEK in both coated and uncoated implants. NanoHA-coated PEEK implants demonstrated higher bone-to-implant contact (BIC) compared with uncoated controls after 12 weeks of healing.

0327

**Description of patterns of mortality in 4 231 consecutive patients treated with dental implants. A comparison between different age groups of patients and normal population over a 15 years period of time.**

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**Objectives** To report the mortality pattern in patients treated with dental implants, and to compare this to mortality in normal populations with regard to age at surgery, gender, and degree of tooth loss.

**Methods** Up to 20 years of Cumulative Survival Rate (CSR) was calculated for altogether 4 231 treated implant patients from one clinic. Information was based on surgical registers in the clinic and the National Population Register in Sweden. Patients were arranged into age groups of 10 years and compared to CSR of the normal population of comparable age, reported in relation to time of surgery, gender, and type of jaw/dentition.

**Results** A similar, consistent, general relationship between CSR of normal population and different age groups of implant patients could be observed for all parameters studied. Completely edentulous patients presented higher mortality than partially edentulous patients ( $P < 0.05$ ). Furthermore, patients in younger age groups showed similar or higher mortality than normal populations, while older patient age groups showed increasingly lower mortality to comparable normal populations, both for edentulous as well as for partially edentulous patients ( $P < 0.05$ ).

**Conclusions** A consistent pattern of mortality in different age groups of patients compared to normal populations was possible to observe indicating higher patient mortality in younger age groups and lower in older patients. The reported pattern is not assumed to be related to implant treatment per se, but is assumed to reflect the variation in general health of treated implant patients compared to the normal population in different age groups.

0328

### Comparative Microbiological Analysis Of Periodontal And Peri-Implant Diseases

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**Objectives** *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Tannerella forsythia*, *Treponema denticola*, *Fusobacterium nucleatum* and *Prevotella intermedia* are the major periodontal pathogens. The aim of this study was to define and compare the microbiologic profile of subgingival plaque in patients with advanced chronic periodontitis, aggressive periodontitis, periimplantitis and also in healthy teeth and implants.

**Methods** Ten patients with clinical and radiologic signs of aggressive and chronic periodontitis (AP, CP), eight patients with periimplantitis, and fifteen healthy teeth and implants were enrolled in this study. Medical histories were taken and recorded. Clinical indices were recorded as four-point measurements on each tooth/implant. Subgingival plaque samples were obtained with sterile paper point from each tooth or implant. The samples were evaluated at Carpegen laboratory using quantitative real-time polymerase chain reaction (qRT-PCR) analysis. Also total amount of the bacterial load was calculated.

**Results** A total of 168 samples were evaluated. Healthy sites harbored less amount of total bacterial load compared to periodontitis or periimplantitis sites. At all of the 8 CP sites; *P. gingivalis*, *T. denticola* and *T. forsythia* were detected. These three bacteria also composed more than 60% of the total harbored bacteria. *A.a* was present only 12.5 % of the CP sites. *T. denticola* and *T. forsythia* were detected all of the AP sites. *P. intermedia*, *T. denticola* and *T. forsythia* were present all 11 of the periimplantitis sites. *P. gingivalis* was detected at 72% and *F. nucleatum* was present 63 % of the periimplantitis sites.

**Conclusions** *P. gingivalis* was mostly found in diseased areas, but *T. forsythia* and *T. denticola* were detected at both healthy and diseased areas. *A. actinomycetemcomitans* was detected only in one patient with advanced chronic periodontitis. Q-RT-PCR seems to be useful method microbiological evaluation for its fast method for detecting multiple pathogenic microorganisms using a small sample.

0329

### Beta-lactam resistance is common among salivary *Prevotella melaninogenica* and related organisms

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**Objectives** *Prevotella melaninogenica* (*sensu lato*) is a ubiquitous colonizer of the mouth and frequent producer of  $\beta$ -lactamase, an enzyme, which leads to resistance to beta-lactam agents. Our aim was to examine the frequency of  $\beta$ -lactamase production and *in vitro* resistance to three commonly used antibiotics in dentistry.

**Methods** Salivary isolates originated from two groups of post-partum women; Group I isolates (n=147) were collected from 38 mothers between 1994-1995, and Group II isolates (n= 81) from 26 mothers between 2003-2004. Isolates were identified to the species level by partial 16S rRNA sequencing: *P. melaninogenica* (n=149), *P. denticola* (n=44), and newly described *P. jejuni* (n=35).  $\beta$ -lactamase production was performed by the nitrocefin disk test. Minimal Inhibitory Concentrations (MICs) of amoxicillin (AMO), amoxicillin/clavulanate (AMC), and metronidazole (MZ) were determined using the agar dilution method. Resistance rates were based on the breakpoints provided by the European Committee on Antimicrobial Susceptibility Testing (EUCAST) and the Clinical and Laboratory Standards Institute (CLSI).

**Results** Of the 228 isolates, 161 (70.6%) produced  $\beta$ -lactamase: 68.7% in Group I and 74.1% in Group II. The majority of *P. denticola* (52.3%), *P. jejuni* (77.1%), and *P. melaninogenica* (74.5%) were positive for  $\beta$ -lactamase production. MIC ranges of *P. denticola* to AMO were <0.125-64, to AMC <0.125-4, and to MZ <0.125-16. Corresponding ranges of *P. jejuni* were <0.125-16, and <0.125-16, and <0.125-128, and those of *P. melaninogenica* <0.125-128, and <0.125-32, and <0.125-128, respectively. *P. melaninogenica* isolates in Group I were more resistant to AMO (28.6% vs. 17.6%) but in Group II more resistant to MZ (0.0% vs. 23.5%). The majority of MZ-resistant isolates were  $\beta$ -lactamase producers.

**Conclusions**  $\beta$ -lactamase production and resistance to tested antimicrobial agents are common among *P. melaninogenica* and related organisms in post-partum women's saliva. Surprisingly, the overall MZ resistance among the tested *Prevotella* isolates was nearly 10%.

0330

### Effect of Essential oil from *Zingiber officinale* on Biofilms of

*Streptococcus mutans*

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**Objectives** *Streptococcus mutans* is known as a key causative agent of dental caries. It metabolizes dietary carbohydrate to produce acids, which reduces the environmental pH leading to tooth demineralization. *S. mutans* is a bacterium that is known to play a significant role in the formation of dental plaques and caries in humans. *S. mutans* produces glucosyltransferase that synthesizes water-insoluble glucan, one of the bacterial extracellular polysaccharide (EPS), from the sucrose contained in foods. Some agents have been studied for the prevention of dental plaque formation. But, these agents are not sufficiently effective to prevent dental plaque. Some agents (fluoride, chlorhexidine vb) are effective. However, they are known as cytotoxic at concentration over certain amount. The aim of this study was to evaluate the effect of essential oil of *Zingiber officinale* against *S. mutans* and biofilm formations of *S. mutans*.

**Methods:** *Z. officinale* (Ginger rhizom) was purchased from local market of Eskişehir, TURKEY. The essential oils were extracted by Clevenger type apparatus, for 3 hours. The MIC of the essential oils was determined in BHI broth using a broth microdilution method in the 96-well microtitre plates. The inhibitory effect of essential oil of *Z. officinale* on biofilm formation by *S. mutans* was performed microtitre plate. Biofilm formation of *S. mutans* is investigated by scanning electron microscopy (SEM).

**Results** *Z. officinale* essential oil inhibited growth of *S. mutans*. The biofilm formation of *S. mutans* was found to be reduced with essential oil of *Z. officinale*.

**Conclusions** In conclusion, the essential oil of *Z. officinale* may play important role reducing pathogenesis of cariogenic properties of *S. mutans*.

0331

### *Streptococcus mitis* response to the competence pheromone

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**Objectives** Pheromones, known as quorum-sensing signals, orchestrate the transition of bacteria from an individual to a social lifestyle. In several streptococci, pheromone sensing mediated by competence-stimulating peptides (CSP) is associated with development of competence for transformation and biofilm formation. This system has been characterized in detail in *Streptococcus pneumoniae*, a close relative of the predominant oral colonizer *Streptococcus mitis*. It is not known, however, the extent to which the *S. mitis* response to CSP, a human commensal, may resemble that in the human pathogen *S. pneumoniae*.

To characterize the global transcriptional response to CSP pheromone in the oral commensal bacterium *Streptococcus mitis* strain NCTC12261.

**Methods** *Streptococcus mitis* transcriptome analysis using RNA sequencing was performed for a thorough assessment of differential gene expression in response to CSP. After analyzing RNA sequencing results, we searched for homologues to competence genes in *S. pneumoniae*. RT-PCR was conducted to establish whether the upregulated genes in response to CSP, with no homologues in *S. pneumoniae*, were early or late CSP-induced genes.

**Results** *S. mitis* transcriptome analysis revealed that 100 genes were upregulated at least two-fold by CSP.

Homologues of *S. pneumoniae* genes acting in transport and fratricide were identified, as well as essential genes involved in foreign DNA uptake and recombination. Among these, we could find 13 genes that did not present any homology with *S. pneumoniae*. All of them showed a time-response to CSP indicative of a late CSP response.

**Conclusions** This is the first transcriptome analysis of *S. mitis* showing the effect of the CSP pheromone. The results showed that the induced genes corresponded to approximately 6% of the *S. mitis* genome, and revealed upregulated sequences not previously identified in *S. pneumoniae*. Elucidating mechanisms used by *S. mitis* to orchestrate group behavior may lead to novel strategies to control dental biofilm associated diseases.

0332

### A new link between two *Streptococcus mutans* pheromones

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**Objectives** *Streptococcus mutans*, a bacterium associated with dental caries, has two different pheromones responsible for induction of competence for natural transformation. The most studied is the competence stimulating peptide (CSP) and the other is the recently discovered *sigX* inducing peptide (XIP). Competence is a physiological state that allows bacteria to take up and incorporate extracellular DNA, such as antibiotic resistance and virulence genes. XIP induces a robust competence response that is independent of the CSP system in chemically defined media (CDM). The aim of this study was to investigate the XIP effect on *S. mutans* global transcriptome profile. **Methods** Whole RNA sequencing was conducted for a comprehensive assessment of changes in gene expression. *S. mutans* cultures were grown in CDM with or without XIP. RNA-seq reads were aligned to the *S. mutans* UA159 genome and visualized using JBrowse. DESeq was used for comparative analysis. Deletion mutants were constructed by PCR-ligation mutagenesis.

**Results** Among the upregulated transcripts were four distinct loci involved in bacteriocin production, as well as the CSP receptor gene, *comD*, and its cognate regulator *comE*. Induction of *comED* was a late response, and depended on SigX, the alternative sigma factor that activates the genes for DNA uptake and recombination. Analysis of the *comED* upstream region revealed a putative SigX-box. Inversion of the SigX-box sequence abolished the XIP inducing effect on *comED* expression, but had no effect on *sigX* expression or on transformation efficiency. Thus, the results suggest that SigX may be the proximal regulator of *comED*.

**Conclusions** In defined medium XIP acted upstream of the CSP-signaling pathway, indicating a hitherto unknown link between the two *S. mutans* pheromone systems. Understanding cell-to-cell communication among oral streptococci, the most predominant bacteria in dental biofilms, may lead to new strategies to fight oral diseases.

0333

### Identification Of Microorganisms From The Periapex Area With The Patients With Chronic Apical Periodontitis

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**Objectives** The aim of this study was to identify microorganisms from periapex lesions with the patients with chronic apical periodontitis after endodontic treatment.

**Methods** Microorganisms were isolated from the area of single-rooted teeth periapex after the endodontic treatment. The samples were taken from 10 patients during surgical procedure, apicoectomy. The full thickness flaps were elevated, and the samples were taken by sterile needle from the lesions and drowned in 2 ml liquid media Sheadler broth (Schaeidler Broth, Oxoid, United Kingdom). The samples were stored in the transport containers and delivered to the Department of Clinical Microbiology in University Hospital Centre Split. The samples were cultivated simultaneously for aerobic and anaerobic cultivation 48 hours. Identification of the grown microorganisms was performed using automated commercial system VITEK 2 (bioMerieux, France) with identification cards for single use for each microorganism.

**Results** In this research 28 different types of bacteria have been identified from the 10 samples of periapical lesions - 18 (64,3%) gram-positive and 10 (35,7%) gram-negative types. Within the total number of bacterial species there are 8 aerobic bacterial species (28,5%), while the remaining 20 are facultative and strict anaerobes (71,4%). The isolated bacterial species are classified as streptococci (21,4%), staphylococci (21,4%), enterobacteria (10,1%), gram-negative non-ferment bacteria (NF) (17,8%) and anaerobic bacteria (29,3%), with respect to their micromorphology and the conditions needed for their cultivation and growth.

**Conclusions** The present study has shown the isolation of 28 microorganisms from a chronic periapical lesions of the single-rooted teeth after endodontic treatment. Anaerobic bacteria were the most prevalent group. From our search of the literature it seems that this might be the first time that *Pantoea agglomerans*, *Oligella ureolytica*, *Pedococcus pentosaceus* and *Peptonihilus asaccharolyticus* are isolated.

0335

### **Histological and Immunohistochemical Evaluation of Kidney Tissues of Rats Exposed to Different Chronic Fluoride Doses Pre- and Postnatally**

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**Objectives** The aim of this study was to evaluate toxic effects and the histopathological changes of high doses of fluoridated water on kidney tissues of rats, that received chronic fluoride (F) doses pre and postnatally.

**Methods** Female rats received 0, 30 and 100 ppm F ad libitum in drinking water, throughout the gestation and nursing periods. After the pups were born, and continued to administer fluoridated water ad libitum as three groups (control, 30 ppm F and 100 ppm F) and followed up for 1, 3 and 5 months, they were sacrificed for determining their kidneys pathology. Rat kidney tissues were removed, sectioned and stained with hematoxylin and eosin (H&E) for the histological observation and stained with the terminal deoxynucleotidyl transferase (TdT)-mediated dUTP-digoxigenin nick end labeling (TUNEL) assay (Roche, Mannheim, Germany) to detect any immunohistochemical changes and/or apoptosis in glomerular and tubular sections.

**Results** F toxicity of the rats has detected in incisors as dental fluorosis. Histopathologic analyses of kidney tissues showed that severe cellular apoptosis increased due to fluorosis and the severity was dependent to F dosage. In 100 ppm F groups, the number of glomerular and tubular apoptotic cells were higher than control and 30 ppm F groups and statistically significant ( $p < 0.0001$ ). In all groups, higher apoptosis values were detected in 5th month rats than 1st and 3rd month ones in glomerular and tubular sections ( $p < 0.05$ ). Under this experimental condition, the transverse section of kidney of 5 month F exposed rats have shown tubular dilatations, glomerular atrophies and necrosis areas, vascular congestions and hemorrhagic regions.

**Conclusions** In conclusion, at the high doses administered and prolonged exposure to F in drinking water, kidney tissues were affected adversely and F caused severe apoptosis in tubular and glomerular sections of rat kidney tissues.

0336

### **Enoxolone (18 $\beta$ -glycyrrhetic acid) in gingival inflammation management : an *in vitro* study**

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**Objectives** Arthrodont® range is a product line of oral healthcare, primarily indicated for gum inflammation treatment. One of the active ingredients is enoxolone (18 $\beta$ -glycyrrhetic acid) which is recognized as a Nonsteroidal anti-inflammatory drug. An *in vitro* inflammatory gingival model has been designed to study its pharmacological activity. In particular, we have investigated its ability to modulate inflammatory cytokines expressed by gingival keratinocytes and known to be involved in gingival inflammatory disease..

**Methods** Primary gingival keratinocytes were established from gingival human tissue samples. Cells were either stimulated or not with mediators of inflammation like TNF $\alpha$  and IL1 $\beta$  and were incubated with assay medium containing the test compound (enoxolone) or the positive control compound (dexamethasone). IL1 $\alpha$ , IL6 and IL8 productions in cell culture supernatants were measured by ELISA. Gene expression of inflammatory actors was assessed by real-time polymerase chain reaction.

**Results** When using this *in vitro* model, we have shown that firstly, the gingival model was able to respond to TNF $\alpha$  + IL1 $\beta$  mix by producing and secreting IL1 $\alpha$ , IL6 and IL8. The presence of dexamethasone led to a significant inhibition of inflammatory response. Secondly we have shown that in the presence of enoxolone, the keratinocyte inflammatory response was also significantly reduced too. The decrease of pro-inflammatory cytokines production was the same as with dexamethasone. Third, the treatment of gingival keratinocytes with enoxolone did not lead to a complete extinction of inflammatory response.

**Conclusions** Together this data demonstrated that the use of enoxolone modulates an inflammatory gingival response. Indeed, it allows for a significant reduction of the expression of cytokines largely involved in inflammatory gingival disease. Our data suggest that 18 $\beta$ -glycyrrhetic acid may provide a modulation of gingival inflammatory response, through attenuating IL1 $\alpha$ , IL6 and IL8 secretion. Therefore, these *in vitro* results confirm the action of enoxolone in the gingival inflammation process.

0337

***Eurycoma longifolia* extract inhibits cell migration of head and neck squamous cell carcinoma**

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**Objectives** *Eurycoma longifolia* is a medicinal plant found in South East Asia and has been widely used as anti-diabetic, antimalarial, antimicrobial and anti-pyretic drug. The aim of this study was to investigate the effect of *E. longifolia* extract on cancer cell migration, which is one of the malignant behavior.

**Methods** The HN22, metastatic phenotype of human head and neck squamous cell carcinoma (HNSCC) cell lines, were treated with *E. longifolia* extract and the cell viability was determined by MTT assay. The expression of MMP-13 was analysed by RT-PCR and ELISA. Wound healing assay were used to measure the cell migration. Statistical differences were assessed using ANOVA at significance level of 0.05.

**Results** *E. longifolia* extract at the concentration of 100µg/ml causes about 60% reduction of cell number. *E. longifolia* at 50µg/ml significantly suppressed MMP-13 mRNA expression and secreted MMP-13. Moreover, *E. longifolia* drastically inhibited cell migration cells in a wound healing assay.

**Conclusions** These results suggest *E. longifolia* as the alternative drug for prevent metastatic of HNSCC.

0338

**Impact of erosive drinks on change of the potential of fluoride and pH value of artificial saliva in vitro**

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**Objectives** This research was conducted in order to demonstrate the impact of daily drinks on the composition of the artificial saliva.

**Methods** For testing artificial saliva potentiometric titration was used to prove the effect of erosive drinks (Drink 1-10) on the hard dental tissue. The potential of fluoride ions in individual sample was measured by using the device with selective electrodes.

**Results** From the tested products remineralization effect of the mineral water Jamnica water (Drink 7) proved due to its ability to replace calcium ions from the lattice of hydroxyapatite with fluoride ions and increase strength of hard dental tissues (enamel and dentin). pH measurement was carried out with a pH meter, the most favorable score had again mineral water Jamnica (Drink 7) whose pH was 6.04 which is the closest pH value to the natural saliva pH (6-6.5).

**Conclusions** Tested artificial saliva proved that certain daily drinks that were tested have potential for inducing remineralization of dental tissue and thus proved the cariostatic effect.



0340

**Relationship between acetaldehyde concentration and tongue coating in HNC patients**

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**Objectives** Acetaldehyde is the first metabolite of ethanol and is known to be carcinogenic, which may contribute to the pathogenesis of head and neck cancer (HNC). Previous study suggests that acetaldehyde concentration in mouth air was associated with tongue coating volume in health volunteers. The aim of study was to investigate relationship between acetaldehyde concentration and tongue coating volume in HNC patients.

**Methods** Twenty HNC patients (12 males and 8 females, range 40-73 years) and 33 healthy volunteers (22 males and 11 females, range 30-87 years) participated in the present study. Acetaldehyde concentration in mouth air was measured by a portable sized monitor. The medical information were age, gender, alcohol sensitivity, drinking and smoking habits, frequency and duration of tooth brushing. Oral health parameters were number of teeth present, mean probing pocket depth, mean clinical attachment level, percentage of sites with bleeding on probing, plaque control records, and score of tongue coating (score 0-3).

**Results** In the HNC patients, acetaldehyde concentration [Median (25%, 75%)] in mouth air was 215.4 (63.9, 626.1) ppb. Acetaldehyde concentration in the HNC patients increased according to the increase in tongue coating score ( $p < 0.001$ ). However, acetaldehyde concentration was not correlated with any other parameters except for number of teeth present. In the healthy volunteers, acetaldehyde concentration was 130.0 (68.2, 242.2) ppb. Acetaldehyde concentration in the HNC patients with the score 2 or 3 of tongue coating status was significantly higher than those in healthy volunteers with the score 2 or 3 ( $p = 0.047$ ).

**Conclusions** Acetaldehyde concentration is associated to tongue coating volume in HNC patients. Furthermore, acetaldehyde concentration in the HNC patients with higher tongue coating score was significantly larger than those in volunteers, which may contribute to the pathogenesis of HNC.

0341

**Clinical evaluation of a new oral care device - a pilot study**

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**Objectives** Several types of oral care devices have been developed in recent years to improve plaque removal efficacy and patient compliance. The aim of the present pilot study was to evaluate the efficacy and safety of a new oral care device (patent pending) comprising a handle and a treatment element which is mounted to the handle.

**Methods** Twenty patients with slight to moderate chronic periodontitis participated in this randomized, controlled, parallel group pilot study. Patients were randomly assigned to one of two groups: Mechanical cleansing with a new treatment device using 1% chlorhexidine gel plus tooth brushing ( $n = 10$ ) or rinsing with 0.12 % chlorhexidine solution (CHX) plus tooth brushing ( $n = 10$ ). At baseline patients received a supragingival prophylaxis and were instructed on toothbrushing and in the use of the new oral hygiene device. The Plaque Control Record (PCR), Gingival Bleeding Index (GBI), bleeding on probing (BOP), Gingival Recession (GR) and Probing Pocket Depth (PPD) were assessed at baseline and after 4 weeks.

**Results** Both treatment regimens demonstrated improvements in plaque and bleeding scores at 4 weeks compared to baseline. At 4 weeks the changes in GBI were significantly greater in the mouthrinse group compared to the mechanical cleansing group ( $p = 0.039$ ). All other parameters were not statistically significantly different between groups ( $p \geq 0.05$ ), however in PCR and BOP there was a trend in favour of the new device. The new oral care device was safe, with no evidence of soft tissue trauma.

**Conclusions** The present pilot study demonstrated that the examined new oral care device combined with toothbrushing can reduce plaque and gingival inflammation. Further clinical trials are required to establish the efficacy of this new device.

0342

### **Gingival Inflammation Associates with Stroke**

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**Objectives** Gingival inflammation is the physiological response to poor oral hygiene. If gingivitis is not resolved the response will become an established lesion. We studied whether gingival inflammation associates with elevated risk for stroke. The hypothesis was based on the periodontitis – atherosclerosis paradigm (Söder et al. Stroke 2005;36:1195).

**Methods** In our prospective cohort study from Sweden 1676 randomly selected subjects were followed up from 1985 to 2012 constituting the study group (for details: Söder et al. J Periodontal Res 2007;42:361). All subjects underwent clinical oral examination and answered a questionnaire assessing background variables such as socio-economic status and pack-years of smoking. Cases with stroke were recorded from Center of Epidemiology, Swedish National Board of Health and Welfare, Sweden, and classified according to the WHO International Classification of Diseases. Unpaired *t*-test, chi-square tests, and multiple logistic regression analyses were used.

**Results** Of the 1676 participants, 39 subjects (2.3 %) had been diagnosed with stroke. There were significant differences between the patients with stroke and subjects without, in pack-years of smoking ( $p=0.01$ ), gingival inflammation (GI) ( $p=0.03$ ), and dental calculus ( $p=0.017$ ). In a multiple regression analysis the association between GI, confounders and stroke, GI showed an association for stroke with odds ratio 2.20 (95% confidence interval 1.02-4.74)

**Conclusions** Our present findings showed that gingival inflammation clearly associated with stroke in this 26-year cohort study.

0343

### **Oral health in patients with early vs. chronic rheumatoid arthritis**

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**Objectives** Rheumatoid arthritis (RA) is chronic autoimmune disease with unknown etiology. We investigated how oral health parameters associate with RA with the hypothesis that patients receiving biological medication show different findings compared with conventionally treated patients and population controls.

**Methods** We examined 81 RA patients in the Helsinki University Hospital. Of them 28 had chronic RA (CRA) with insufficient response to synthetic disease modifying anti-rheumatic drugs (sDMARDs), 53 were DMARD native/early RA (ERA), and 43 age and gender matched subjects served as controls. Dental status was recorded, salivary analysis conducted, and 28-joint Disease Activity Score (DAS28) calculated. One year later the same examinations were repeated on RA patients (CRA and ERA). Results were statistically analyzed (Mann-Whitney test and multivariate analyses) and given with means and interquartile ranges (IQR) and *p*-values.

**Results** Gingival bleeding on probing (BOP)-index was highest in ERA (15, IQR 8 to 26), lower in CRA (8, IQR 3 to 19,  $p<0.05$  vs. ERA), and lowest in controls (4, IQR 2 to 8,  $p<0.05$  vs. CRA and ERA). The number of teeth with  $\geq 4$ mm deep periodontal pockets was also significantly higher in ERA (7, IQR 3 to 12) and CRA (4, IQR 3 to 12) than in controls (1, IQR 0 to 3,  $p<0.05$  vs. ERA and CRA). Decayed Missing Filled Tooth (DMFT) index associated positively with age and DAS28-score. Unstimulated salivary secretion associated negatively with male gender, DAS28 and number of teeth in multivariate linear regression analyses of ERA and CRA groups combined.

**Conclusions** The results partly confirmed our study hypothesis by showing that RA-patients had more periodontal findings compared with controls and also that DMFT index and salivary secretion values associated with the RA disease activity. Acknowledgement: Supported by Helsinki University Hospital research funds.

0344

**Autoimmune diseases and oral health in a Swedish cohort**

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**Objectives** Oral infections up-regulate a number of systemic inflammatory reactions which, in turn, play a role in the development of systemic diseases. We investigated the incidence of severe autoimmune diseases in a cohort followed-up for 26 years with known oral health status. The hypothesis was that poor oral health parameters associate with autoimmune diseases.

**Methods** A study population of 1676 patients from Stockholm County (Sweden), 30-40 years old in 1985 was followed-up for 26 years and their cumulated hospital admissions were recorded from the Swedish national register. The WHO International Classification of Diseases (ICD 9 and 10) was used to analyze the incidence of hospitalization of the patients due to autoimmune disease (American Autoimmune Related Diseases Association). 33 patients with ICD autoimmune diagnoses were detected. Their oral health and background variables were statistically analyzed and compared with those with no hospitalization.

**Results** We found no statistically significant difference in oral health between patients with and without autoimmune disease. Dental calculus index was higher in the patients, but not significantly ( $0.63 \pm 0.01$  vs.  $0.45 \pm 0.01$ ). Only three patients (9%) had >5mm periodontal pockets vs. 282 (17%) of the 1643 subjects with no autoimmune disease. Smoking and snuff use did not differ between the groups. The patients were on average more seldom in working life than those with no autoimmune disease (18% vs. 8.5%  $p = 0.06$ ).

**Conclusions** Patients with autoimmune disease had higher levels of calculus index compared with subjects without autoimmune disease. This might reflect differences in oral hygiene habits. Patients with autoimmune disease also participated less frequently in working life, probably due to the disease.

0345

**PREVALENCE OF TEMPOROMANDIBULAR DISORDERS IN THE VIETNAMESE ELDERLY AGED 65-74 YEARS OLD.**

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**Objectives** Aim of the current study was to describe prevalence of symptoms and signs of temporomandibular disorders (TMD) in the Vietnamese elderly.

**Methods** A total of 258 Vietnamese elderly people living in rural and urban areas of Danang city aged 65-74 years old (130 males and 128 females) were selected. A cross-sectional study was conducted through two strategies for the specific diagnosis TMD: fourteen questionnaires concerning symptoms of TMD were used to obtain anamnestic data followed by clinical examination of TMJ and associated structures according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) axis I.

**Results** The prevalence of TMD symptoms were as follows: masticatory pain 17.8%; headache 49.6%; jaw joint noise 29.1%; jaw locking 3.5% and 62% had at least one symptom of TMD. Females had statistically significant association of TMD with headache. Among all participants 38% had disc displacement with reduction and in 35% degenerative joint disease were diagnosed; 3.5% had myalgia. No statistically significant differences were detected between genders in clinical diagnosis according to the DC/TMD axis I.

**Conclusions** This population based study indicates a high prevalence of TMD symptoms in 65-74 years old people. There were no gender differences regarding TMD. Disc displacement reduction and degenerative joint disease were the most common diagnosis among Vietnamese elderly community.

0346

### **Looking for offspring's oral health care information through E-consultation**

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**Objectives** Internet has become a new infra-structure to seek health care information. Parents are the ones who would chase oral health care information for their children. The aim of our study was to find out what they pose about their offspring's oral care through a free consultation portal of dentistry.

**Methods** "PersianDentist.ir" is one of the most visited Persian websites of dental care and has a free consultation part that allows parents to ask questions about their children's oral health. This part opened 3 years ago. Questions about children extracted and categorized in two levels: (1) prevention levels, (2) needed treatments. Age and gender of children and their parents were analyzed if they were mentioned. Statistical analysis was performed in SPSS 21 by Chi-square test.

**Results** From all 1850 question, 93 were in pediatrics. The mean age of children was  $4.95 \pm 3$ . The gender of child was not mentioned in 25.8% questions and was boy in 36.6%. Tertiary prevention level was the most asked care (51%). Moreover no significant relationship was found between gender or age of child and level of demanding prevention.

Caries, fillings, and pulp therapies were the most, and fluoride therapy was the least questioned treatments.

The most questions from the age of 9 months to 2.5 years old were about primary prevention (50%). However, in the age groups of 2.5 to 6 and 6 to 12 years old, the questions were mostly about complex treatments (77% and 48%, respectively).

**Conclusions** Insufficient demand for information on primary prevention is alarming. Spreading information through internet about the critical role of primary dentition in child's oral and general health should become a priority.

0347

### **Effect of a dentifrice containing sodium tripolyphosphate on calculus development**

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**Objectives** Polyphosphates are generally included in dentifrice formulations for their stain removal/prevention properties but also for their anti-calculus function (as crystal growth inhibitors). This study investigated the effect of twice-daily brushing with an anhydrous 0.454% w/w stannous fluoride dentifrice containing 5% w/w sodium tripolyphosphate (STP) versus standard fluoride dentifrice on supra-gingival calculus formation, in a calculus-prone population over 12 weeks.

**Methods** This was a single centre, examiner blind, randomised, stratified (by gender and Volpe-Manhold Index [VMI] score), parallel design study in healthy volunteers. Post-screening, eligible subjects (non-smokers, aged  $\geq 18$  years) received oral prophylaxis to remove all supra- and sub-gingival calculus, and used a standard fluoride dentifrice for the next 6 weeks (calculus formation phase). Subjects who formed sufficient calculus on the lingual surfaces of six anterior mandibular teeth (total VMI score  $\geq 7.0$ ) received a second oral prophylaxis, were stratified by gender and VMI score and randomised to treatment. Subjects brushed twice daily with either the 5% w/w STP dentifrice or standard dentifrice control for 12 weeks (treatment phase). Calculus formation was assessed after 6 and 12 weeks of treatment.

**Results** Subjects using the 5% w/w STP dentifrice exhibited significantly less calculus formation ( $p < 0.0001$ ) compared to the standard dentifrice group after 6 and 12 weeks' twice-daily brushing. Thirty-nine subjects reported 82 treatment-emergent adverse events with only 3 classified as oral Adverse Events; all oral adverse events were mild-to-moderate intensity and none were considered to be treatment related.

**Conclusions** A 0.454% w/w stannous fluoride dentifrice containing 5% w/w STP significantly prevented calculus build-up compared to standard fluoride dentifrice after 6 and 12 weeks' twice-daily brushing.

This study was funded by GSK Consumer Healthcare.

0348

**Cost-effectiveness of sugar free gum in the prevention of caries**

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**Objectives** The study's objective is the evaluation of cost-effectiveness of sugar free gum in the prevention of caries. **Methods** The development of the current status quo in dental health care is projected on a time horizon of 62 years ("Current consumption"). This is compared to a scenario where the consumption of SFG is increased to the Finnish level of consumption ("Increased consumption"). Every tooth can transfer between the stages "No caries", "1-4 area filling", "Partial crown", "Crown" and "Bridge / Prosthesis / Implant". Due to differences in the risk of caries our model distinguishes between front teeth and molar teeth.

Transition probabilities were calculated based on German epidemiological data derived from the DMS IV.

Costs were calculated from the payers perspective including all costs for fillings and dentures.

**Results** The results at the end of the observation period show that an increase in the SFG consumption in Germany leads to a significant improvement in dental health care. In the scenario "Current consumption", 14 teeth have a denture at the end of the observational period. In the scenario "Increased consumption", eight teeth had to be replaced. On average, the increase in SFG consumption results in one more caries-free tooth (7 caries-free tooth in scenario "Increased consumption" and eight caries-free teeth in scenario "Current consumption"). A patient at the age of 74 has six more healthy teeth in the scenario "Increased consumption" than in the scenario "Current consumption".

In the scenario "Current consumption", lifetime costs of 17,199.96 € accrue, which corresponds to average annual costs per patient of 277.42 €. Lifetime cost in the scenario "Increased consumption" account for 12,188.92 €. This leads to average annual costs per patient of 196.60 €. According to this, an increase in the consumption of SFG leads to annual cost savings for the SHI of 80 € per patient. For the lifetime period, cost savings of 5.000 € occur per patient from the perspective of the SHI.

**Conclusions** An increased consumption of SFG leads to both improvement of oral health and cost savings for the German health care market.

0349

**A randomised clinical trial to investigate the effects of an experimental dentifrice on oral volatile sulphur compound levels**

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**Objectives** To compare total volatile sulphur compounds (VSCs), hydrogen sulphide (H<sub>2</sub>S) and methyl mercaptan (CH<sub>4</sub>S) in mouth air following brushing with an experimental dentifrice (0.3% zinc chloride, 5% sodium tripolyphosphate and 1.0% alumina with 927 ppm fluoride) or a reference dentifrice (927 ppm fluoride).

**Methods** Single centre, examiner blind, randomised, crossover study (7 to 21 days washout). Eligible subjects were ≥ 18 years with ≥ 20 natural uncrowned teeth and baseline mouth air samples with a mean H<sub>2</sub>S concentration >300 parts per billion (ppb). Subjects brushed twice daily with allocated dentifrice for 7 days. On day 8, overnight mouth air samples were obtained prior to brushing and at 5 min, 1, 2 and 3 h post treatment of 1 min brushing followed by 10 s swirl of slurry and expectoration. Treatment responses were log-transformed, then analysed by ANCOVA.

**Results** Of 50 subjects randomised, 46 completed all phases of the study. There was a significant reduction in VSCs (adjusted least squares mean ± SE ppb) from baseline at 5 min for experimental (0.33 ± 0.03; p<0.0001) but not reference dentifrice (0.02 ± 0.03; p=0.46). At the other time points, both dentifrices had significantly lower levels of VSCs compared to baseline. CH<sub>4</sub>S and H<sub>2</sub>S levels from baseline were significantly reduced at all time points except at 5 min for reference dentifrice H<sub>2</sub>S levels.

Treatment differences were seen in favour of the experimental dentifrice for all measures at 5 min and for total VSC at 2 and 3 h, CH<sub>4</sub>S at 1 and 2 h. There were 11 adverse events in 10 subjects (seven oral, four non-oral); all were mild in intensity, not considered treatment-related and resolved by study completion.

**Conclusions** The experimental dentifrice demonstrated significant reductions in VSC levels compared with the reference dentifrice immediately after brushing. This study was funded by GSK Consumer Healthcare.

0350

### **Treatment Modalities of Partial Edentulism**

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**Objectives** The purpose of this study was to determine the prevalence of various types of partial edentulism and types of prosthetic restorations most commonly chosen to treat the patients.

**Methods** The institutional ethical board reviewed and approved this study. A retrospective evaluation was conducted in Department of Prosthodontics, Yeditepe University, Faculty of Dentistry, by examining the digital record system of the faculty. The patients were selected randomized and the inclusion criteria were; patients with panoramic radiographs, partial edentulism at least on their one jaw, whose treatment had been finished, and who had left without any treatment. Age, gender, Kennedy classification and treatment modalities (overdenture, removable partial denture, fixed partial denture, implant or no restoration) were recorded. There were 345 patients (147 males, 198 females) with the mean age of  $50.88 \pm 14.09$  years. Descriptive statistical methods and Chi-square tests were used to analyze the data. An alpha level of 0.05 was used for all statistical analyses.

**Results** Kennedy III was the most common edentulism type in maxilla (71.1%) and mandible (55.9%), whereas Kennedy IV was the least common type (2.8% in the maxilla, 0.7% in the mandible). Removable partial dentures were more prevalent in Kennedy I and II patients (68% and 51.3%, respectively), while fixed partial dentures were more prevalent in Kennedy III and IV patients (76% and 57%, respectively). Dental implants were the least common treatment option (20% for Kennedy I, 25% for Kennedy II, 10% for Kennedy III and 28% for Kennedy IV) ( $p < 0.01$ ).

**Conclusions** The prosthetic treatment modalities according to Kennedy classification showed that the conventional treatments were frequently selected. The patients may be encouraged for the current implant treatment.

0351

**One-year clinical evaluation on conventional and endo-crown retained three-unit FPDs. Pilot study.**

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**Objectives** Clinical evaluation and longevity of five three-unit FPDs with endo-crown on the distal abutment tooth and five conventional FPDs are assessed and compared.

**Methods** Twenty five patients with identical tooth lost on the maxillary or mandibular dental arch are examined. Five of them are chosen with step of randomization (n=5). A Split-mouth study design is applied consistent with the CONSORT Statement. The type of the preparational design (conventional or endo-crown) on distal abutment tooth is also randomly chosen for each side of the dentition. Both FPD's are fabricated with laboratory resin composite (Vita LC/VM) and frame of glass fibers (Stick Tech, GS/C&B). Silan agent is applied on the inner aspects of the bridges and three-step etch-and-rinse adhesive Optibond FL (Kerr/Hawe) is used on tooth surfaces. Luting is performed with RelyX U200 Adhesive Resin Cement (3MESPE). Clinical evaluation is rated according modified USPHS criteria at 3, 6, and 12 month postoperatively. Descriptive statistics were used for frequency distributions of the evaluated criteria. Parametric t-test or nonparametric Mann-Whitney test are chosen depended on the type of empirical distribution, verified One-Sample Test ( $\alpha$  was set at 0.05). Analysis of longevity is carried out by Kaplan-Meier survival test.

**Results** The modified UHPS criteria showed A (Alfa) scores on all test parameters. The statistical analysis revealed insignificant differences in marginal adaptation and marginal discoloration at any recall time. Kaplan Meier survival analysis showed 100% survival rate for all FPD's – conventional and endo-crown retained.

**Conclusions** Within the limitations of this study it is concluded that both conventional and endo-crown retained FPDs have excellent clinical acceptance for one-year evaluation.

0352

**Five-year survival of metal-ceramic and composite crowns in routine public dental care - A retrospective multicenter study**

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**Objectives** The main aim of this study was to investigate and compare the 5-year survival and complication rates of metal-ceramic crowns and composite crowns made within routine public dental care in three Swedish counties. An additional aim was to explore the associations between background factors (gender, tooth position and root canal treatment) and the survival of the different types of crowns.

**Methods** Data were retrospectively retrieved from dental records from a random sample of 600 adult patients (200 from each county) who had been treated with either a metal-ceramic single crown (n=300) or a composite crown (n=300) in premolar and molar position during the year 2005. Data were recorded from the time of treatment and for the following 5 years. Survival (the crown still in function), root canal treatment, and frequency and type of complications were recorded. Descriptive statistics, Chi-square tests and logistic regression analyses were applied.

**Results** The 5-year survival rate was significantly higher for metal-ceramic crowns than for composite crowns (93% vs. 70%; OR 5.6; 95% CI 3.4-9.3;  $p < 0.001$ ). This difference was stable irrespective of county, gender, tooth position and root canal treatment (OR 5.2; 95% CI 3.1-8.7;  $p < 0.001$ ). More complications were recorded for composite than for metal-ceramic crowns giving 51% vs. 91% of the respective type of crown in function without complications ( $p < 0.001$ ). In separate analyses by type of crown an association was indicated, for metal-ceramic crowns, between root canal treatment without post and core and a lower survival rate (83%; ns). For composite crowns, the survival rate was higher for women than for men (75% vs. 65%;  $p = 0.049$ ).

**Conclusions** Metal-ceramic single crowns, performed in routine dental care, have a better 5-year prognosis than extensive composite restorations (composite crowns) on premolar and molar teeth. Metal-ceramic crown therapy on root-filled teeth may require a post and core for long-term survival.

**0353**

**As an infrastructure material, are fibers biomimetic at multilayer-ceramics?**

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**Objectives** The application of veneering porcelain over a high-strength core ceramic or metal infrastructure resulted in the creation of aesthetically acceptable laminated composite systems. Unfortunately, different elastic properties of these multilayer restorations resulted in difficulties of understanding elaborated biomechanical behaviors. The aim of this study was to evaluate the effect of resin infiltrated fiber infrastructure under veneering ceramic to stress transmission pattern.

**Methods** A 3-Dimensional mathematical model simulating a multilayered ceramic crown restoration and its abutment was modeled. Metal-ceramic (1), zirconium ceramic (2), lithium disilicate ceramic (3), and fiber-ceramic restorations were four different models. A 300 N static load was applied to occlusal surface of multilayered ceramic crown.

**Results** Maximum von stress values were observed at occlusal contacts of veneering ceramic. Maximum stress values observed at supporting dentin structures were; 13.18 MPa for Metal-ceramic, 13.26 MPa for zirconium ceramic, 10.22 MPa for lithium disilicate, and 6.53 MPa for fiber-ceramic.

**Conclusions** The results of current study showed that use of fiber infrastructure and veneer ceramic combination decreases stresses on supporting tooth structures. The use of fiber infrastructure and veneering ceramic may mimic natural dentin and enamel tissues in a biomechanical manner.

**0354**

**Shear bond strength on provisional materials for improved individualization and repair**

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**Objectives** The aim of this investigation was to evaluate bonding opportunities for the individualization and repair of provisional chemically curing paste/paste materials.

**Methods** Shear bond strength was determined between plates (2 mm, length 20 mm, width 10 mm) made of two provisional materials (a) Protemp 4, b) experimental provisional material) and cylinders (d= 5mm, height 3mm) made of three different materials: a) provisional material (Prottemp 4), b) experimental provisional material, and c) flowable composite (Filtek Supreme Flowable, polymerization for 20s with Elipar S10 (3M Espe, G)). The cylinders were applied onto the plates after different surface treatments: 1: with oxygen inhibition layer (IL), 2: without IL (removed with 70 % ETOH) 3: IL with bonding (B, Scotchbond Universal SBU, 10s), and 4: without IL with bonding (all materials 3M Espe, G) resulting in 14 material combinations. 24hrs after fabrication shear bond strength was determined following ISO TR 11405 (v=1mm/min, n=10). Bonding areas were classified into adhesive (failure between cylinder and plate), mixed and cohesive failure. Mean and standard deviation were calculated and statistical analysis was performed with one-way ANOVA / Bonferroni ( $\alpha=0.05$ ).

**Results** SBS values varied between 16.2 MPa (a,IL,B,c) and 26.8 MPa (b,c). For both plate materials highest SBS was found with Filtek Supreme flow, only on Prottemp 4 the exp. material showed comparable high values. Highest SBS was provided with/without inhibition layer and lowest values were found with inhibition layer and bonding. For the combination of provisional materials, in tendency higher values were found for exp. material. The statistical comparison revealed significant ( $p=0.000$ ) differences between the systems. Dominate failure pattern was a cohesive failure.

**Conclusions** All material combinations provided good SBS on provisional materials. Highest bonding values can be achieved on both materials using a flowable material on a surface with/without inhibition layer.



0355

**An examination of the heat-conductive properties of temporary luting cements**

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**Objectives** The purpose of this study is to determine the thermal conductivity of temporary cements with different content ex vivo.

**Methods** Kalzinol and Temp Bond NE were examined. These materials were prepared according to the manufacturer's instructions and were applied to standard molds. Ten samples of each material were prepared. Measurements were taken using a Heat Conduction Unit (P.A. Hilton Ltd. UK). Heat conducting coefficient was calculated for each sample using the Fourier equation. Coefficients were statistically analyzed by the Kruskal-Wallis test.

**Results** Significant differences were found between the materials ( $p < 0.05$ ). The conducting coefficient of Kalzinol was found to be higher than that of the Temp Bond NE ( $p < 0.05$ ).

**Conclusions** Thermal characteristics were affected by composition and chemical nature of temporary luting cements.

0356

**Corrosion of alloys with and without dynamic loading**

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**Objectives** To evaluate corrosion resistance of different casting alloys using the established static corrosion test method and an in house developed dynamic test method.

**Methods** The dental alloys were investigated both static according to ISO 22674:2006 and dynamic causing a deflection of the alloy within the elastic area using a Bose Electroforce 3330 Test Instrument. The static test specimens were cast sheets with dimensions (34 x 13 x 1,5)mm and for the dynamic specimens (32 x 6 x 1)mm. The alloys were one Pd – Ag alloy, Aurolite 2B (Pd: 59,9, Ag: 26,3, Au: 1,7, In: 5, Sn: 5, Zn: 2, Ru: < 1) and two Co – Cr alloys, Wirobond 280 (Co: 60,2, Cr: 25, Mo: 4,8, W: 6,2, Ga: 2,9, Mn: < 1) and d. Sign 30 (Co: 60,2, Cr: 30, Ga: 3,9, Nb: 3,2, Mo, Al, Li: < 1) respectively. In the dynamic test the alloys were exposed to 500 000 cyclings during seven days under otherwise the same conditions as the static tests. The elements released in the corrosion solution were determined by ICP-MS.

**Results** The corrosion tests indicated relatively small amounts of elements released compared to the limits stated in ISO 22674:2006. The results from the dynamic corrosion test showed less total release of elements from Aurolite 2B and Wirobond 280 and only a slightly increase for d. Sign 30 compared to the static tests. The tests also showed that small variations in the composition of Co-Cr alloys, for example by addition of Nb, may lead to changes in the release of elements.

**Conclusions** The corrosive resistance of the alloy was acceptable in both tests with metal release lower than the limits stated in ISO 22674. In this study dynamic load had little or no effect on the amount of element released.

0357

**Shear bond strength of different opaquer between titanium and composites.**

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**Objectives** Evaluate the shear bond strength (SBS) of using four different opaquer between titanium alloy (Ti6Al4V) and one indirect laboratory composites.

**Methods** Four chemically different opaquer (GC Gradia, Shofu Ceramag, Ivoclar Vivadent SR Nexco Paste, Bisco Tescera) and one indirect laboratory composite (GC Gradia) were bonded on the 80 Ti6Al4V disks to test SBS. These 80 samples were divided into 2 main groups; first group (a) treated by thermal cycle and the other group (b) had no thermal cycle. These 2 groups also divided into 4 subgroups by brand names of opaquer. After sand-blasting of machined Ti6Al4V disk samples, GC Metal Primer II as a metal primer and GC Gradia indirect laboratory composite used for all samples. For Group 1a/b (n=10), GC Gradia opaque used and selected as a control group which samples were prepared according to manufacturers advise. For group 2a/b, group 3a/b, group 4a/b and; Shofu Ceramag, Ivoclar Vivadent SR Nexco Paste, Bisco Tescera opaquer were used respectively. All samples were tested by Instron for SBS. Finally, debonded surfaces are evaluated by Modified Adhesive Remnant Index (ARI) (Score 0 = no opaquer on the surface, Score 1 = <1/2 covered with opaquer, Score 2 = >1/2 covered with opaquer, Score 3 = completely covered with opaquer).

**Results** There were significant differences between SBS of opaquer groups ( $p < 0.01$ ). Before thermal cycle application, the highest mean of SBS is found in the control group; Group 1b. After thermal cycle, Group 3a had the highest mean of SBS ( $p < 0.01$ ). In all debonded surfaces when detected by modified-ARI, incidence Score 0 (38) was more frequent followed by Score 1 (33), Score 2 (8) and Score 3 (1).

**Conclusions** Different but chemically appropriate metal primer and opaquer together can be used for preparing or repairing indirect laboratory composite as a superstructure for Ti6Al4V.

0358

**Streptococcus mutans level versus sIgA concentration in smokers saliva**

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**Objectives** The level of Streptococcus mutans (SM) colonies of cariogenic bacteria of  $10^5$  CFU (number of colony-forming unit) or higher in mL of the saliva reveals high risk of dental caries. Secretory Immunoglobulin A (sIgA) agglutinates microorganisms including SM. The aim of the study was assessment of sIgA concentration in smokers saliva in relation to SM bacteria colonies in the saliva.

**Methods** Questionnaire, biochemical and microbiological studies were conducted in the group of 120 people- 56 smokers and 64 people who never smoked. The mean age of smokers was 31.77 and 29.04 of non-smokers. Saliva was collected between 9.30 and 11.30 am, 1.5 to 2 hours after the meal. sIgA concentration in the saliva was determined with the use of sIgA ELISA Kit test (Immunodiagnostik AG, Germany), level of SM bacteria with the use of CRT bacteria test (Ivoclar, Vivadent, Liechtenstein). Obtained study results were submitted to statistic analysis using Mann-Whitney test. Test values of  $p < 0.05$  were considered statistically significant. The research project obtained the positive opinion of the Bioethics Board of the Medical University of Lublin.

**Results** In smokers who had the level of SM equal or higher than  $10^5$  CFU/mL sIgA concentration in the saliva was  $790.63 \mu\text{g/mL}$  whereas in smokers with SM level lower than  $10^5$  had the value of  $979.46 \mu\text{g/mL}$  ( $Z = 0.32$ ,  $p > 0.05$ ). For non-smokers the values were  $800.00 \mu\text{g/mL}$  and  $619.01 \mu\text{g/mL}$  respectively. In the group of non-smokers with SM level equal or higher than  $10^5$  CFU/mL sIgA concentration in the saliva was significantly higher in comparison to the group of non-smokers with SM level below  $10^5$  CFU/mL ( $Z = 1.92$ ,  $p < 0.05$ ).

**Conclusions** No significant differences were stated between sIgA concentration in the saliva and the SM level in smokers.

0359

**Immune cells in labial salivary glands of type 1 diabetics**

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**Objectives** To investigate if the labial salivary glands of patients with type 1 diabetes (T1DM) display inflammatory changes and to characterise the immune profile of these potential inflammatory cell infiltrates and determine if they are associated with salivary gland hypofunction.

**Methods** Labial salivary gland biopsies obtained from 20 patients with T1DM aged 18-30 years ( $25.23 \pm 2.25$ ), and 20 healthy age- and gender-matched controls were analysed for inflammatory changes and distribution of CD4-, CD8-, CD20-, CD25-, CD68- and vascular endothelial growth factor-receptor 2 (VEGF-R2)-positive cells by immunohistochemistry. Unstimulated, chewing-stimulated whole saliva and stimulated parotid saliva flow rates were also measured.

**Results** In 8/20 (40%) of the patients with T1DM and 7/20 (35%) of the healthy controls, various stages of chronic inflammatory reactions were observed, but in the T1DM group the focal inflammatory cell infiltrates (based on focus scoring) were significantly larger than in the control group. There was no correlation between the degree of inflammation and the salivary flow rates, although 20% of the patients had abnormal low unstimulated and chewing-stimulated whole saliva flow rates (hyposalivation). The most extensive distribution of CD4-, CD8-, CD20- and CD68-positive cells were observed in periductal lymphocytic infiltrates in the T1DM group. Generally, there were no CD25-positive cells present. The VEGF-R2-immunoreactivity was abundant and seen in relation to endothelial cells, and particularly in lymphocytic infiltrates.

**Conclusions** Our findings indicate that the immunopathology of T1DM is reflected in the salivary glands displaying focal inflammatory cell infiltrates comprising both T-helper and T-cytotoxic cells, B-cells and macrophages.

However, the immune-mediated focal infiltrates do not appear to affect the salivary gland function. Our findings warrant further immunological studies including a larger number of patients and controls.

0360

**Streptococcus mutans level versus the number of cigarettes smoked daily**

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**Objectives**

The number of *Streptococcus mutans* (SM) equal or higher than  $10^5$  CFU (number of colony-forming unit) in mL of the saliva reveals high risk of caries. Analysis of cotinine concentration in the saliva allows to verify the questionnaire data and objective assessment of cigarette smoking status. The aim of the study was determination of cotinine concentration in the saliva and assessment of SM level in smokers saliva in relation to the number of cigarettes smoked per day.

**Methods** Questionnaire, biochemical and microbiological studies were conducted in the group of 53 smokers. The mean age of the investigated was 31.77. 43.40% smoked up to 10 cigarettes daily and 56.60% more than 10 daily. The study material was saliva collected between 9.30 and 11.30 am, 1.5 to 2 hours after the meal. Cotinine concentration in the saliva was assessed with the use of Cotinine test (Calbiotech, USA). The number of SM bacteria colonies was assessed using CRT bacteria test (Ivoclar, Vivadent, Liechtenstein). Obtained study results were submitted to statistic analysis with the use of Chi<sup>2</sup> test. Test values of  $p < 0.05$  were considered statistically significant. The research project obtained the positive opinion of the Bioethics Board of the Medical University of Lublin.

**Results** In all the investigated declaring cigarette smoking the presence of cotinine in the saliva was stated. Mean concentration of cotinine in the saliva was 305.61 ng/mL. SM level equal or higher than  $10^5$  CFU/mL was stated in 46.67% people smoking more than 10 cigarettes daily and 30.43% people smoking up to 10 cigarettes daily. The level lower than  $10^5$  CFU/mL was stated in 53.33% and 69.57% of the investigated respectively ( $\chi^2 = 1.43$ ,  $p > 0.05$ ). **Conclusions** No statistically significant differences were stated in SM level in relation to the number of cigarettes smoked daily in smokers.

0362

**Evaluation of potential risk factors for saliva volume using data from the Studies of Health in Pomerania**

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**Objectives** Previous studies support a dependency of xerostomia on drugs and gender, while age did not seem to play a role. Thus, the aim of this study was to investigate associations between age, gender or drugs and saliva volume using data from the Study of Health in Pomerania (SHIP).

**Methods** Data from the 11-year follow-up of the Study of Health in Pomerania (SHIP-2) and the baseline study of SHIP-Trend were pooled. Subjects were 20-93 years old. Regular medication intake was categorized as 0, 1-2 or 3+ drugs. Saliva collection was performed with commercially available Salivette® (Sarstedt, Nümbrecht, Germany). Saliva volume was determined. Multilevel methods were used to account for clustering of subjects with both SHIP surveys.

**Results** In total, 6102 subjects (SHIP-2: N=2229; SHIP-Trend: N=3873) were analyzed. Mean saliva volume was 967.0 µl (SD 433.3). Saliva volumes did not differ significantly between males (975.8 µl) and females (958.7 µl; p=0.11) and according to 10-year age groups (p>0.05). However, saliva volume decreased significantly with an increasing number of regularly taken drugs (981.7, 963.2 and 954.9 µl, respectively; p trend=0.02).

**Conclusions** In contrast to other studies, saliva volumes did not differ according to gender. However, negative associations with age were confirmed. Interestingly, the number of drugs regularly taken was significantly affecting saliva volume.

0364

**Salivary Cytokines in Liver Transplant Recipients**

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**Objectives** Liver transplant (LT) recipients are at risk for infections and malignancies due to lifelong immunosuppression. Interleukin-1β (IL-1β) and tumour necrosis factor-α (TNF-α) are cytokines reflecting systemic inflammation. Our aim was to analyse salivary IL-β and TNF-α concentrations in LT recipients and investigate how liver disease aetiology, oral health or lifestyle habits associate with these cytokines.

**Methods** 84 LT recipients, which further divided into 64 chronic liver disease (CLD) and 20 acute liver failure patients (ALF), had a clinical oral examination 2-11 years (median 6 years) after transplantation. A questionnaire was filled out and stimulated whole saliva samples were collected for determining cytokine concentrations with Quantikine HS ELISA, R&D Systems. Statistical analyses were performed with SPSS 21 and Mann-Whitney U-test served for comparing groups.

**Results** Mean concentrations of both cytokines were higher, but not significantly, in CLD patients compared with ALF. Mean TNF-α concentration was significantly higher in smokers (9 smokers in CLD and 4 in ALF) compared to non-smokers (13.8 pg/ml vs. 5.4 pg/ml; p=0.005). Patients with diabetes (19 diabetics in CLD and 2 in ALF) showed twice as high concentrations of salivary IL-1β compared to patients without diabetes (330 pg/ml vs. 176 pg/ml; p=0.008). Poor oral hygiene, alcohol consumption, and oral mucosal lesions were associated with higher levels of IL-1β and TNF-α but these differences were not statistically significant.

**Conclusions** Contrary to our hypothesis, no difference was observed in studied salivary cytokines levels of transplant patients whose liver disease had been acute vs. chronic. Of background variables only smoking and diabetes associated significantly with higher salivary IL-1β and TNF-α levels. Anyhow, these cytokines reflect systemic inflammation and may aide in overall risk assessment in LT recipients.

0365

**Comparison of two mouthrinses in xerostomia treatment**

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**Objectives** Assess the efficacy, safety and clinical acceptability of GUM HYDRAL moisturizing gel (Sunstar) and compare it with the gold standard Oral balance/Biotene gel (GSK) in the relief of signs and symptoms of xerostomia.

**Methods** In this double-blind study a group of 40 subjects affected by dry mouth, was split in two groups of 20 using a stratified randomization list: group A was treated with the GUM HYDRAL gel; group B was treated with the Oral Balance/Biotene gel. Each patient was characterized by means of an unstimulated (WRS) and a stimulated

(WSS) whole saliva flow determination test at  $t_0$  and was asked to complete a "patient questionnaire" at the same time of the day at  $t_0$ ,  $t_1$  (after 1<sup>st</sup> week),  $t_2$  (2<sup>nd</sup> week),  $t_3$  (3<sup>rd</sup> week) and at the end of the trial,  $t_4$  (4<sup>th</sup> week), and a "daily journal", with a VAS scale and some questions about Quality of Life (QoL) improvement.

Results Mann-Whitney U test and unpaired t-test analysis were performed. At the baseline there were no statistically significant differences between group A and B ( $p>.05$ ). During the treatment group A patients reported an higher and more enduring improvement in dry mouth perception, in their sensation of taste and a better gel taste; group B patients reported an higher reduction in number of night awakenings at  $t_1$  and  $t_2$ . With both groups there was an improvement regarding QoL, dry mouth sensation, comfort while chewing, swallowing and talking, with no statistically significant differences between them.

Conclusions GUM HYDRAL gel was as effective as the gold standard Oralbalance/Biotene in the dry mouth relief, and even superior in some specific parameters, without any side effect. Whatever the product the longer the period of use was, the more and longer the dryness was reduced, in favor of a long-term use of such products.

### 0366

#### **Salivary IgA levels before and after dental treatment in children with intellectual disabilities**

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Objectives Salivary IgA levels were evaluated in children with intellectual disabilities (ID) before and after dental treatments.

Methods Thirty children were enrolled and divided into two groups: Group 1: children with ID, and group 2: systemically healthy children. All dental treatments were carried out in one session under general anesthesia. Unstimulated saliva samples were collected one day before and one week after the dental treatment.

Results Both groups showed significant differences between pre and post-treatment salivary IgA levels ( $p<0.05$ ). However, there were no statistically significant difference in terms of salivary IgA concentration neither before nor after the treatment ( $p>0.05$ ).

Conclusions Elevated levels of salivary IgA alone may not be concluded as a conclusive evidence of microbial dental disease, in children with ID. The decrease of IgA levels after dental treatment is considered to be indicative for reduced bacterial load irrespective of the medical status of the patients.

### 0367

#### **Preventive and Restorative Treatment Approach of Horizontally Fractured Anterior Tooth Crown**

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Objectives To represent the preventive and restorative treatment approach of maxillary central incisor with horizontal crown fracture.

Methods A 17 year-old male patient was referred to Department of Restorative Dentistry clinic the day after the trauma occurred. Clinical and radiological examination revealed that there were horizontal crown fracture with pulp exposure in maxillary left central incisor on crown-root conjunction line. At the first step, root canal preparation was performed with reciprocal endodontic equipment (Resiproc, VDW, Munich, Germany) under local anesthesia and was filled conventionally. Secondly, 2/3 of root canal filling was emptied with a special post drill and fractured coronal segment was extracted. Finally, a fiber post (Unicore, Ultradent, Salt Lake City, UT, USA) and fractured coronal fragment was fixed simultaneously with adhesive resin cement (Panavia F, Kuraray, Japan) according to instructions of manufacturer. The follow-up was performed after six months.

Results Clinical and radiological examinations at six-months follow-up showed that the preventive and restorative treatment of maxillary left central incisor was asymptomatic and pleasurable.

Conclusions Preventive and restorative treatment approach of fractured coronal fragments is a better treatment option than prosthodontic and implant applications.

**0368**

**Management of a complicated crown fracture using autogenous tooth fragment: Two-case reports**

Ince, S., Ozcelik, M.

Selcuk University

**Objectives** Reattachment of tooth fragment to a fractured tooth remains as the treatment of choice because of its simplicity, natural esthetics and conservation of tooth structure. The aim of this study was to present management of crown fracture in two injured patients using adhesive resin cement and original tooth fragment.

**Methods** Case 1: A 25 year-old male patient reported to the Department of Endodontics, Faculty of Dentistry, Selcuk University with the complaint of pain in the upper anterior tooth. A history of trauma, 2 days earlier due to a fall was given. Clinical examination revealed a complicated crown fracture and non-separated fragments involving right maxillary central tooth. Root canal treatment for the involved tooth was planned and the fractured fragment was re-attached using Super Bond C&B (SunMedical, Shiga, Japan) resin cement. Case 2: A 22 year-old male patient reported to the Department of Endodontics, Faculty of Dentistry, Selcuk University with pain and mobility. The patient had a history of trauma due to bicycle accident. Right maxiller central tooth had a horizontal fracture line involving the crown pulp. Root canal treatment for the involved tooth was planned. Non-separated fracture was then re-attached using Super Bond C&B (SunMedical, Shiga, Japan) resin cement.

**Results** The re-attached crowns were satisfying for the patients. The patients had no pain after root canal treatment. The controls verified that re-aatchment of the root fragments is a successful treatment method.

**Conclusions** This study present re-attachment of fractured crowns using adhesive methods. Inshortterm, this can be an acceptable method however longterm clinical studies are needed to confirm clinical success of the technique.

**0369**

**Multidisciplinary Rehabilitation of Traumatized Maxillary Central Incisor: Case report**

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<sup>1</sup>Ege University Dental Faculty, <sup>2</sup>Ege University Dental Faculty, <sup>3</sup>Ege University Dental Faculty

**Objectives** Complete multidisciplinary rehabilitation of traumatized maxillary central incisor.

**Methods** A 20 years old female patient was referred to our clinic complaining of the non-esthetic appearance of her maxillary right central incisor. During the clinical examination the tooth was sensitive to percussion and did not respond to the vitality test. Radiographic examination also reveled an immature root formation. At the first appointment the root canal was biomechanically prepared and calcium hydroxide was used as the intracanal medicament. Four weeks later, mineral trioxide aggregate mixture was placed in the apical 4mm of the root canal and obturation was completed using gutta percha and a resin-based sealer. The pulp chamber was then sealed with fiber reinforced composite resin expanding the reinforcement to coronal mid third of the tooth. Following office bleaching using hydrogen peroxide, the tooth was restored using a combination of various shades and transparent composite resins. White lesions were also imitated using an opaque tint. Gingival recession was temporary masked using a pink shade composite resin and the aberrant frenulum was excised. After 3 months of follow up the pink composite resin was removed and gingival recession was covered with a connective tissue graft and coronally advanced flap using a periodontal microsurgical approach.

**Results** The healing was uneventful and no complication was observed. At the 12<sup>th</sup> month evaluation, the tooth was asymptomatic and without any periapical pathosis. The final aesthetic outcome was satisfactory for the patient.

**Conclusions** The use of MTA as an orthograde apical plug and reinforcement of the tooth structure with fiberglass and composite resin combination could facilitate an optimum clinical outcome. Appropriate composite layering technique and utilization of tints followed by periodontal plastic surgery could improve both the white and pink aesthetics.

**0370**

**Endodontic management of a discolored tooth with external invasive resorption and open apex**

Coban, A. N.<sup>1</sup>, Dinc, D.<sup>2</sup>

<sup>1</sup>Selçuk University, <sup>2</sup>Selçuk University

**Objectives** To describe the management of external invasive resorption using MTA (Mineral trioxide aggregate) and to eliminate the discoloration due to previous endodontic treatment.

**Methods :** A 22 year old male patient referred to Selçuk University Faculty of Dentistry, Department of Endodontics. The patient's complaints are discolored and short restored maxillary incisor tooth. The patient reported no previous toothache. Root canal treatment was 5 years ago. Radiographic examination indicated an immature tooth (I1) with a wide-open apex, gutta-percha overflowing and a radiolucent area. Treatment options were explained the patient and the patient accepted the treatment plan. Conventional endodontic retreatment was performed using traditional files and calcium hydroxide paste as intracanal dressing. After 7 days, open apex treated with MTA plug, canal was filled with thickened gutta-percha point and AH plus sealer. Later, treatment procedure was initiated intracoronal bleaching with 35% hydrogen peroxide. Internal bleaching is very successful in the short term. After 7 days, aesthetically restoration was made with direct composite restoration.

**Results** The results of the case showed that apical barrier formation and complete periapical healing is possible with apical placement of the MTA plug. Apical plug can be considered very effective in stimulating regeneration of apical tissue in immature permanent teeth with open apex, even if direct contact of the material with the root canal walls is not achieved at some parts of the MTA-dentin interface. Six-months radiographic control showed that the treatment was successful and new bone formation could be observed in the periapical region which is a sign of optimal seal.

**Conclusions** Conventional endodontic retreatment and MTA plug of permanent tooth with open apex can be successfully used. In such cases, can be effectively treated with a conservative approach and apical MTA plug.

**0371**

**NON-SYNDROMIC MULTIPLE IMPACTED PERMANENT AND SUPERNUMERARY TEETH: A CASE REPORT**

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<sup>1</sup>AFYON KOCATEPE UNIVERSITY, <sup>2</sup>INONU UNIVERSITY

**Objectives** Supernumerary teeth (ST) or hyperdontia is a developmental anomaly and has been argued to arise from multiple aetiologies. ST may remain embedded in the alveolar bone or can erupt normally into the oral cavity. ST can be single or multiple, unilateral or bilateral, and seen in one or both jaws. ST are located generally in the anterior part of maxilla, but can be found in any region of the dental arches. ST are usually asymptomatic, and are detected on radiologic evaluation. Multiple ST rarely occurs without being associated with syndromes. The purpose of this report is to present a case with multiple impacted teeth in which no syndrome or systemic conditions were detected.

**Methods** A 15 year-old female patient referred for orthodontic treatment. The patient had a symmetrical face with a convex profile. She was in the permanent dentition with an Angle Class II molar relationship. Cone Beam Computerized Tomography and panoramic examination revealed that there were four unerupted permanent teeth and seven unerupted ST. Four unerupted teeth and five of ST were in the mandibular central region and the other two in the maxillary canine region.

**Results** Before orthodontic treatment, two maxillary premolar teeth and five of ST were in the mandibular central region and the other two in the maxillary canine region was extracted. The duration of orthodontic treatment was 26 months. The following results were achieved: overjet 2 mm, overbite 2 mm, correction of the class II bite, eruption of impacted teeth, correction of the inclination and rotation of the teeth. The teeth were aligned in the arches in the correct manner and an optimal relationship between the teeth was achieved. After twelve months there was no relapse.

**Conclusions** Numerous unerupted ST and permanent teeth is a very rare situation. This situation is in the interest of orthodontics and can be successfully managed with comprehensive orthodontic mechanics.

0372

**Orthodontic Treatment of a Severe Crowding and a Narrow Maxilla with the Damon System**

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<sup>1</sup>Orthodontist / Private practice, <sup>2</sup>Selcuk University, Faculty of Dentistry

**Objectives** To present the non-extraction treatment of a severe crowding and a narrow maxilla with the Damon system.

**Methods** A 15 year 5 month old female presented to the clinic with 12.3 mm maxillary and 1.6 mm mandibular crowding, anterior crossbite and maxillary narrowness. She had Class I molar relationships on both sides. Initial cephalometric analysis showed that SNA, SNB, ANB, U1-SN and IMPA were 80.1, 81.6, -1.5, 104.7 and 97.2 degrees, respectively. 3D cast analysis showed that intermolar width was 36.5 mm and intercanine width was 31.86 mm. 0.022-inch-slot Damon Q system was used for orthodontic treatment

**Results** At the end of the treatment, narrowness of the maxillary arch was eliminated. A Class I molar and canine relationship with an ideal overjet and overbite was achieved. Cephalometric analysis showed that SNA, SNB, ANB, U1SN and IMPA were 81.3, 81.6, -0.3, 109.7 and 97.2 degrees, respectively. Post-treatment study cast analysis showed that intermolar width was 38.76 mm and intercanine width 36.49 mm. The treatment lasted two years.

**Conclusions** The Damon system is a non-extraction treatment choice for patients who have narrow dental arch. Patients who have mild to moderate maxillary narrowness and severe crowding in maxilla can be solved successfully with Damon system without tooth extraction.

0373

**“Evolution of removable dentures - a new team approach”**

Watzke, R.

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Current leap in evolution of removable dentures is digitization of treatment procedure for dentist and dental-technician. The Wieland digital-denture-system offers different procedures for fabricating CAD/CAM removable dentures. Treatment starts with anatomical impressions and preliminary bite-registration with centric-tray, which can be combined with extraoral registration device UTS CAD (Wieland Dental + Technik GmbH & Co.KG) to determine the occlusal plane (parallelism to bipupillar line and camper`s plane). Impressions and preliminary bite registration are scanned (minimum lab-scanner D500, 3Shape) and individual bite plates with a gothic-arch-tracing-device (Gnathometer CAD, Wieland) are digital designed and milled using PMMA discs (Tray Disc for Zenotec) and Zenotec select ion milling unit (both Wieland). Alternatively, individual bite plates in wax-rim-design can be created digitally and computer-aided-manufactured using ProArt Wax Disc for Zenotec (Wieland) and Zenotec select. Either with individual designed/milled PMMA trays (combined with Gnathometer CAD) or with wax-rim-trays mouth-closed functional impressions of upper and lower jaw are taken. With extraoral device (UTS CAD) occlusal plane is verified (parallelism to bipupillar line and camper`s plane). Aesthetic lines can be marked on trays followed by tooth form and shade selection. Relation between upper and lower jaw is determined either by Gnathometer CAD or wax bite. All information (impressions, jaw-relation, aesthetic) are digitized by scanning and dentures can be designed and fabricated using IvoBase CAD for Zenotec (Wieland) for milling denture base, SR-Phonares-II or SR-Vivodent-DCL (Ivoclar Vivadent AG) as denture teeth and IvoBase CAD Bond (Wieland) for bonding teeth to denture base. Final 3-step-dentures can be placed into patient`s mouth. If treatment team needs tryin to verify dentures` design before final fabrication a “denture-teeth-and-base tryin-monobloc” can be milled (Tray Disc for Zenotec). Alternatively, wax-tryin-dentures can be milled (ProArt Wax Disc for Zenotec, SR-Phonares-II/SR-Vivodent-DCL) which can be transferred into final dentures with conventional injection system (IvoBase, Ivoclar Vivadent AG).



**0374**

**Dentistry goes digital**

Woestmann, B.

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Though dentistry in the future will be clearly digital (think of traditional and digital photography and the rapid change in this field) nowadays many digital techniques in dentistry are still in their early phases. Though CAD/CAM based laboratory milling and manufacturing processes are well established in the fabrication process for fixed restorations, high performance ceramics (Zirconium dioxide) are unthinkable without a digital process and intraoral scanning is one of the most interesting developments in modern prosthodontics as it is the decisive step that makes it possible to circumvent the error prone traditional way of impression taking and model casting, digital dentistry only now starts to establish in other dental fields. Besides the many new approaches to integrate digital techniques into the workflow in implant dentistry, there are highly interesting workflows and procedures in the field of removable and complete dentures. The latter being a very formidable challenge as digital construction of complete dentures needs an entirely new workflow. Based on the data available proposed workflows will be reviewed and the strength and weaknesses of the proposed workflows and procedures will be outlined.

**0375**

**Experiences with digital dentures**

Stoher, T.

University Hospital Heidelberg, Germany

Objective: A new process, Digital Denture (Wieland Dental + Technik, Germany), enables CAD/CAM produced complete dentures. The objective of this study was to examine the feasibility of the Digital Denture workflow in dental practice. Materials and Methods: The Digital Denture – process is based on innovative appliances, software and dental materials, all certified for dental use (CE). Conventional impressions were taken and bite registration was performed with Centric Tray and Gnathometer CAD (Ivoclar Vivadent, Liechtenstein). Impressions and bite registration were digitalized via scanner (3shape, Denmark). Denture bases were digitally designed and milled from PMMA discs (IvoBase CAD for Zenotec, Wieland Dental + Technik, Germany) in a CAM unit (Zenotec Select Ion milling unit, Wieland Dental + Technik). Finally, prefabricated denture teeth (SR Phonares II, Ivoclar Vivadent) were glued with a bonding material (IvoBase CAD Bond, Wieland Dental + Technik) to the CAM produced denture base. Alternatively, the same digitally designed dentures were milled in wax (Pro Art Wax Disc for Zenotec, Wieland Dental + Technik). After try-in of the wax denture in the patient, dentures were manufactured via a conventional injection system (IvoBase High Impact, IvoBase Injector, Ivoclar Vivadent). Results and Conclusions: CAD/CAM produced complete dentures were placed in 5 patients. Some problems of the conventional denture manufacturing process could be avoided, such as polymerisation shrinkage with imperfect fit and variable amount of residual monomer. The clinical Digital Denture workflow as well as the communication dentist – dental technician was documented and evaluated. When placing the CAD/CAM produced dentures suction effect, jaw relationship, vertical dimension, and aesthetics were controlled and compared with the dentures that were digitally designed, milled in wax and produced via the IvoBase injection system.

**0376**

**The oral mucosa as drug delivery route – advantages and disadvantages**

Carpenter, G.

King's College London Dental Institute

In the mouth saliva constantly covers the oral mucosa. Although it is mostly water it acts nothing like water and can easily solubilise lipophilic molecules (such as emulsions) and help improve their transfer through the oral mucosa. In addition, a subset of salivary proteins binds to the oral epithelial cells to form the oral mucosal pellicle. This mucin-rich layer alters the hydrophobicity of the mucosal surface and acts a place where drugs can be localised or concentrated by mucoadhesive materials such as chitosan. The binding of salivary mucins onto the oral mucosal cells is via the membrane-bound mucins such as Muc 1. Against these features that may help drug transfer into the mucosa is the constantly flowing salivary film which rapidly washes away drugs away the mucosa.

0377

**Models and methods to evaluate transport of drug delivery systems across the oral mucosa**

Jacobsen, J.

Section for Pharmaceutical Design and Drug Delivery, University of Copenhagen, Denmark

Predictable permeability models are a prerequisite for exploring the oral cavity as a potential route of drug delivery. The models are valuable tools in the discovery of new chemical entities and drug delivery systems to evaluate the amount of drug taken up, rate of transmucosal permeability, mechanisms, bioavailability, or safety and efficacy. The presentation will address a number of important factors in order to select the proper model for evaluation of oromucosal drug delivery. Considerations include complexity of barrier properties, control of experimental conditions, animal species versus human tissue, region or whole oral cavity, ease of drug analysis, in vitro/ex vivo/in vivo/in silico correlations, and time frame.

0378

**Drug permeation enhancement via the oral mucosal route**

Patel, M.

Queen Mary, University of London, United Kingdom

The presentation focuses on drug permeation enhancement via the oral mucosal route using iontophoresis. Enhanced delivery of model species via iontophoresis across buccal mucosa has been confirmed by experimental and theoretical data. In vitro data show that iontophoresis also enhance the delivery of large molecules, like dextrans and parvalbumin, across polymeric hydrogel systems and buccal mucosa. This creates new approaches to drug delivery and opens pathways to further research for delivering therapeutic agents topically and systemically.

0379

**Are there differences in the performance of similar composites?**

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**Objectives** To compare polymerization shrinkage, depth of cure (DoC), microhardness (VHN), flexural strength (Fs) and modulus (Ef) of resin-based composites characterized by similar composition and indications.

**Methods** Four universal composites (Gradia Anterior, Gradia Posterior, G-aenial Anterior, G-aenial Posterior; GC Corp.), one low-shrinkage posterior composite (GC Kalore; GC Corp.) and two flowable composites (G-aenial Flo and G-aenial Universal Flo; GC Corp.) were used to prepare 5 samples per group per test. Polymerization shrinkage was measured using the digital correlation method based on two cameras (Aramis GOM, Schaumburg, Germany). The DoC was measured using a modified ISO4049:2000 scrapping method in which the uncured material was removed by dissolving in ethanol. VHN was measured using a microhardness tester (Buehler Indentament 1100 series, Buehler). Fs and Ef were measured as per ISO4049:2000 in a three-point bending setup using a universal testing machine (PCE-FM200, PCE Instruments). Data were statistically analyzed using one-way ANOVA with Tukey's post-hoc test and the paired t-test at  $\alpha=0.05$ .

**Results** G-aenial Flo and G-aenial Universal Flo had higher peripheral shrinkage ( $3.11\pm1.54\%$  and  $2.51\pm1.05\%$ , respectively) and central shrinkage ( $0.81\pm0.60\%$  and  $0.98\pm0.61\%$ , respectively) than other materials ( $p<0.05$ ), whose shrinkage was in the range of 0.81-1.03% peripherally and below 0.5% centrally. The greatest DoC was observed for Kalore ( $3.56\pm0.16$  mm). Microhardness varied between 47 and 56 VHN with significant differences between materials but no differences between top and bottom surfaces of the same material. Fs of G-aenial Universal Flo ( $99.15\pm13.83$  MPa) and Ef of Kalore ( $5.42\pm0.51$  GPa) and G-aenial Universal Flo ( $5.38\pm0.44$  GPa) were higher compared to other materials ( $p<0.05$ ).

**Conclusions** Similarities in shrinkage parameters were found for universal composites as well as for flowable composites. Conversely, no clear pattern was observed in DoC, VHN, Fs and Ef between composites of similar composition and indications.

0380

### **Real-time investigation of the curing kinetics of visible light-curing resin based composites available on the European market**

Steinhaus, J.<sup>1,2</sup>, Wieland, M.<sup>1</sup>, Haenel, T.<sup>1,2</sup>, Hausnerova, B.<sup>2,3</sup>, Moeginger, B.<sup>1</sup>

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**Objectives** Recent publications demonstrated the applicability of dielectric analysis (DEA) for real-time curing monitoring of visible light-curing resin based composites (VLC RBC) to investigate curing kinetics and characterize changes in the resin composition. The aim of this comparative study was to compare the curing behaviour of 26 different VLC RBC (tested also in two different shades) available on the European market using DEA. Furthermore, it was tested if the DEA method is suitable for quality assurance methods by detecting changes in the initial ion viscosity of the different composite types.

**Methods** A DEA 231 Epsilon with Mini IDEX sensors (Netzsch Gerätebau, Selb, Germany) was used to measure the ion viscosity with a frequency of 1,000 Hz at a temperature of 36°C. Every measurement was repeated 5 times (n=5). The initial ion viscosity of the VLC RBC (16 micro-, 7 nano-hybrid-, 2 bulkfill composites and 12 flowables) was measured prior to curing for 1 minute. Then the VLC RBC were cured using a Bluephase 20i in High Modus (Ivoclar Vivadent AG, Schaan, Liechtenstein) for 30s.

**Results** The investigated VLC RBC can be clearly distinguished from each other with respect to initial ion viscosity (quality assurance application, see figure) by DEA investigation. The analysis of their curing behaviours provides significantly different kinetics parameters with respect to shade (A3 cures faster than B2, B3 or C2) and with respect to monomer composition (RBC containing Bis-EMA cure slower). Data scatter was much lower in the primary curing phase until vitrification than in the highly cured state where there is hardly any ion mobility. In this respect the DEA is a complementary method to the cure monitoring with FT-IR showing high scatter in the primary curing phase. Generally the data scatter increased with the filler content.

**Conclusions** DEA is a reliable, simple and sensitive method to detect batch variations in the quality assurance of the production of VLC RBC as well as a tool for curing kinetics characterisation of VLC RBC with respect to monomer composition in VLC RBC development.

0381

### **Effect of LEDs on the micromechanical properties of a nanohybrid-composite**

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University of Munich

**Objectives** To investigate the effects of different curing modes of two LEDs from two exposure distances on the micromechanical properties of a nanohybrid-composite.

**Methods** Seventy-two composite (Kalore/GC) specimens with 2mm thickness (n=6) were cured with two high irradiance LEDs (Bluephase 20i/Ivoclar, FlashMax P3/CMS Dental) at 0 and 7 mm exposure distances. The curing conditions were; Grup a: Bluephase20i–10s–High power, Grup b: Bluephase20i–15s–High power, Grup c: Bluephase20i–5s–Turbo, Grup d: Bluephase20i–15s–Soft start, Grup e: FlashMaxP3–4mm tip–3s, Grup f: FlashMaxP3–without tip–3s. The transmitted light power and energy density were evaluated at specimens' bottom in real time during curing with a radiometer (MARC Resin Calibrator). Vickers hardness(HV) and modulus of elasticity(E) were measured with an automatic universal hardness indenter(Fisherscope H100C) at specimens' top and bottom surfaces after storing 24 hours in distilled water at 37°C. Effects of energy densities, exposure distances and surface conditions were analyzed using One-way ANOVA, Tukey and t tests(p=0.05).

**Results** Different energy densities were observed for all groups in terms of distance and surface conditions. A decrease in intensity and energy density was formed when the exposure distance was removed from 0 to 7 mm in all groups. The highest HV( $76.61 \pm 5.85 \text{ N/mm}^2$ ) and E( $10.42 \pm 5.85 \text{ GPa}$ ) values were observed in the Group b at 0 mm, whereas the lowest HV( $49.41 \pm 13.11 \text{ N/mm}^2$ ) and E( $6.63 \pm 1.87 \text{ GPa}$ ) values were observed in the Group e at 7 mm at the top surfaces (p<0.05). Increasing the exposure distance significantly impaired the micromechanical properties of the top and bottom surfaces in the Group e(p<0.05).

**Conclusions** The light intensities of LEDs were higher than the manufacturers' report. Different light energy densities( $0.01 \text{ J/cm}^2$ – $23.13 \text{ J/cm}^2$ ) and exposure distances(0–7mm) influenced the micromechanical properties of top and bottom surfaces of a nanohybrid-composite. The micromechanical properties of a nanohybrid-composite were more affected by the energy density than the light intensity.

0382

# **Effects of Temperature on Primary Curing Kinetics of Light Curing Dental Composites Investigated by Dielectric Analysis (DEA)**

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**Objectives** Many publications show clearly that temperature affects the final degree of cure (DC) of visible light curing resin based composites (VLC RBC). However, there is a non-uniform situation concerning the temperature dependent reaction rate during the first stages of curing. Some researcher e.g. Daroch et al found a “significant” increase of reaction rate by a factor 1.5 to 2 if the temperature is raised from 20°C to 50°C. Price et al found an increase of factor 1.5 being a not significant (p=0.16). These small changes are surprising as the viscosities of TEGDMA-BisGMA based resins change typically by a factor 5 to 10 leading to the conclusion that the reaction rate should correspondingly increase due to the higher molecular mobility.

**Methods** DEA has a good time resolution of 10 to 20 data points per second if a frequency of 1,000 Hz is used and was thus applied to investigate the reaction kinetics using a Netzsch DEA 231. The investigated VLC RBC were camphorquinone initiated Arabesk Top OA2 and Grandio, VOCO, Germany.

**Results** It was found that there is almost no significant temperature dependency of both reaction rate and initiation time during the phase of primary curing in the temperature range 30 to 50°C. This can be explained either by the low activation energy of 20 kJ/mole for photo-initiation or by the assumption that the rate of radical annihilation increases in a way that compensates for the viscosity decrease.

**Conclusions** For dentists this is in principle good news as they need not to bother much about the temperature effects on reaction rate of VLC RBC if it is camphorquinone initiated.

ANOVA evaluation for a = 0,05 with respect to the temperature dependency of the characteristic parameters of the ion viscosity curves

	ANOVA evaluation	ANOVA evaluation
threshold value of ANOVA evaluation	3,06	3,06
evaluated characteristic parameters	Arabesk	Grandio
slope B between 10 and 30 s	4,89	1,80
end ion viscosity	1,96	2,49
initiation time t <sub>init</sub>	1,92	5,47
reaction time constant 0τ <sub>reac</sub>	0,95	1,67

0383

# **The Effect of Whitening Toothpastes on Surface Roughness of Dental Composites**

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**Objectives** The aim of this in-vitro study was to evaluate the effect of different toothpastes on the surface roughness of four different dental composite materials.

**Methods** Four different composite materials [Ceram X & X-Flow (Dentsply DeTrey GmbH), Filtek Supreme XTE and Filtek Silorane (3M ESPE)] were treated with three different toothpastes [two whitening toothpastes: Rembrandt Plus Toothpaste (RP) (Johnson & Johnson GmbH) and Colgate Sensation White (CSW) (Colgate-Palmolive GmbH), and a non-whitening toothpaste: elmex® Intensive Cleaning toothpaste (eIC) in combination with the elmex® Sensitive Toothpaste (GABA GmbH)]. From each composite material 45 samples (diameter: 4,5mm, thickness: 2mm) were prepared (n=15/toothpaste) and polymerized by using a LED-unit according to the manufacturer’s instructions. After polymerization, the samples were embedded in self-curing acrylic resin and polished (4000 grid). The slurry used for each abrasion cycle (12.5ml) was prepared by using human saliva and the representative toothpaste in a relation 3:1. The abrasion process was performed with a frequency of 200 movements/minute. The surface roughness of each sample was measured by using laser profilometry at three different time periods: T<sub>0</sub>: baseline, T<sub>1</sub>: after two-weeks tooth-abrasion simulation and T<sub>2</sub>: after 12-weeks tooth-abrasion simulation.

**Results** The surface roughness of all composite materials was increased by all toothpastes. The effect of toothpastes was material dependent. For Ceram X and Filtek Silorane, the increase of surface roughness was not significant different among the toothpastes ( $p>0.05$ ) after 2-weeks abrasion. For all composite material/toothpaste combinations the abrasion time had a significant effect on the surface roughness ( $p<0.05$ ). After 12-weeks abrasion, CSW caused lower increase of roughness compared to the other toothpastes ( $p<0.05$ ).

**Conclusions** All toothpastes increased the surface roughness of the composite materials. Longer abrasion periods resulted in significant increase of the surface roughness suggesting that if the use of such toothpastes is desired then short application periods are recommended.

#### 0384

##### **Influence of the quantity of extraction solvent on monomer leachability from dental composites**

Cokic, S. M.<sup>1</sup>, Duca, R.<sup>2</sup>, Hoet, P.<sup>2</sup>, Van Meerbeek, B.<sup>1</sup>, Godderis, L.<sup>2</sup>, Van Landuyt, K.<sup>1</sup>

<sup>1</sup>KU Leuven, <sup>2</sup>KU Leuven

**Objectives** To determine whether the volume of extraction solvent influences monomer leachability from dental composites.

**Methods** Composite disks of two commercial dental composites (Filtek Supreme XTE, 3M ESPE, Seefeld, Germany and Gaenial Universal Flow, GC, Tokyo, Japan) were prepared using teflon molds ( $h=2\text{mm}$ ;  $d=5.75\text{mm}$ ). After application, the unpolymerized composite was covered with a glass plate, in order to prevent formation of an oxygen inhibition layer and polymerized for 40s using a light curing lamp with an output  $>1100\text{ mW cm}^{-2}$ . Next, the disks ( $n=10$ ) were placed in a glass vial with either 1ml, 2ml or 3ml of extraction solvent (100% ethanol with deuterated diethylphthalate as internal standard). Either after 7 or 30 days at  $37^{\circ}\text{C}$ , the supernatant was collected and the amount of released monomers (BisEMA, BisGMA, UDMA, TEGDMA) and Bisphenol A was measured with liquid chromatography mass spectroscopy (LC-MS/MS, Acquity Systems, Waters, USA).

**Results** For both tested composites, the highest amount of released monomers was measured after sample incubation in 3ml, while the lowest amount was measured in 1ml of extraction solvent. Furthermore, there was no significant difference noted in quantity of released monomers in the same volume after 7 and 30 days of incubation.

**Conclusions** The amount of solvent certainly plays an important role in the monomer release from dental composites, which must be attributed to a saturation effect and the development of an equilibrium, which slows down further monomer release. This also explains why longer incubation times do not lead to more monomer release.

#### 0385

##### **Efficiency of different repair kits on bonding to aged dental resin composite substrates**

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**Objectives** To assess the efficiency of intraoral repair kits on the tensile bond strength (TBS) of resin composites (RCs) to aged RC substrates.

**Methods** 840 aged (six months,  $37^{\circ}\text{C}$ , distilled water) RC substrates (Tetric EvoCeram) were air-abraded (CoJet) with and without following phosphoric acid contamination or treated with silicon carbide (SiC) grinding paper. Seven repair kits were used as intermediate agents (Embrace First-Coat, CLEARFIL CERAMIC PRIMER, Tokuso Ceramic Primer, Monobond Plus+Heliobond; Scotchbond Universal, One Coat Bond and visio.link) for conditioning. Specimens were repaired using two direct RCs (Clearfil Majesty ES2 and Clearfil Majesty Posterior), stored in distilled water ( $37^{\circ}\text{C}$ , 24h) and thermal aged ( $5^{\circ}\text{C}/55^{\circ}\text{C}$ , 10,000 cycles). The cohesive strength of the repair RCs ( $N=40$ ) served as control and was determined by applying the RCs on the fresh polymerized substrates, followed by thermal-aging procedure. TBS and failure types were determined and evaluated with three-/one-way ANOVA, and chi-square test ( $p<0.05$ ).

**Results** The highest influence on the TBS was exerted by the intermediate agent (repair kit) (partial eta squared  $\eta^2 = 0.320$ ,  $p<0.001$ ), while the impacts of the repair RC ( $\eta^2 = 0.017$ ,  $p<0.001$ ) and surface pre-treatment ( $\eta^2 = 0.015$ ,  $p=0.003$ ) were significant but low. Except for Embrace First Coat and Tokuso Ceramic Primer, phosphoric acid contamination after air-abrasion maintains the TBS. The predominant type of failure was adhesive (46.2%), followed by cohesive (39.2%), while mixed (6.1%) or pre-failure (3.1%) was rarely observed.

**Conclusions** Air-abrasion of aged substrates improved the repair strength inducing superior TBS compared with grinding the surface with SiC paper prior to repair, while the effect of phosphoric acid contamination is material dependent. Analyzed universal adhesives, as well as the combination between a universal primer and an adhesive were in-vitro efficient intermediate agents for repairing aged RCs, while the use of silane primers alone was less efficient.

0386

### **Influence of adhesive resin application on shear bond strength of repaired aged-resin composite**

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**Objectives** To assess the efficiency of different adhesive systems on the repair bond strength of resin composite to aged-resin composite substrates and evaluate whether using a silane containing adhesive or introducing silane as an additional step makes a difference.

**Methods** A total of 105 cylindrical substrates were fabricated from a nanofill resin composite (Clearfil Majesty Esthetic, Kuraray), aged and treated with silicone carbide paper to standardize the surfaces. Then they were divided into 7 groups of adhesive systems (n=15) which were used as intermediate repairing agents: 1. no treatment, used as control 2. Single Bond Universal Adhesive (3M ESPE) 3. Composite Primer (GC Europe) 4. PQ1 (Ultradent Products) 5. Silane + PQ1 (Ultradent Products) 6. Clearfil Universal Bond (Kuraray) 7. All Bond Universal (Bisco). After the application of adhesives according to the manufacturers' recommendations, specimens were repaired with the same resin composite used to fabricate the substrates. The shear bond strengths were measured using a universal testing machine. Data were analysed by one-way ANOVA and Tukey's post-hoc tests ( $p=0.05$ ).

**Results** The highest bond strength was obtained with Single Bond Universal Adhesive while the lowest result was obtained when resin composite was repaired without using any adhesive layer (control group) ( $p<0.05$ ). Silane+PQ1 showed statistically higher results than PQ1 and control groups ( $p<0.05$ ).

**Conclusions** Overall, higher shear bond strengths were demonstrated when aged composite resin was repaired with silane-based adhesive systems. Using a silane containing adhesive or introducing silane as an additional step has the same effects on repair. However the results of the study indicate that repair bond strengths of the adhesive systems used are material dependent.

0387

### **Effects of Laser and Preventive Treatments on Root Caries Prevention**

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**Objectives** The aim of this study is to evaluate the preventive effects of Er,Cr:YSGG laser, 5% NaF varnish, a new calcium-phosphate based material Teethmate Desensitizer (TMD) and their combinations on root dentin demineralization in vitro.

**Methods** 98 human third molar collected and crowns were separated from cemento-enamel junction. Cementum was removed by carborundum discs (3M, Espe, USA). Root dentin samples sealed by two layers of acid resistant nail varnish except of a 4x4 mm<sup>2</sup> window and then divided into 7 groups: Group 1: no treatment/intact dentin (negative control), Group 2: only pH cycling group/artificial caries (positive control), Group 3: 5% NaF varnish, Group 4: TMD, Group 5: Er,Cr:YSGG laser (4.4 J/cm<sup>2</sup>), Group 6: laser+NaF, Group 7: laser+TMD. After preventive treatments were done, samples submitted to 18 days of pH cycling in an oven at 37 °C. And then the samples were sectioned bucco-lingually through middle of the window and cross-sectional microhardness testing was performed by Knoop Hardness at 20, 50, 80, 110, 140, 170, 200 µm depths from the outer dentin surface. Surface morphology is analyzed by SEM and AFM. Statistical analyses were done by Levene's Test for Homogeneity and Tukey's Studentized Range test.

**Results** Knoop hardness of Group 6 was statistically higher than other groups at 20, 50, 80, 110, 140 µm ( $p<0.05$ ).

No statistically significant differences were found between group 1 and group 6 at 170 µm; group 1, group 6 and group 7 at 200 µm ( $p>0.05$ ). Partially tubular occlusion and CaF<sub>2</sub> like formations on dentin surface of experimental groups were verified by AFM and SEM images.

**Conclusions** Within the limitations of this study, combination of Er,Cr:YSGG laser irradiation at 4.4 J/cm<sup>2</sup> and 5% NaF varnish can increase the acid resistance of human root dentin.

0388

#### **Cell-free remineralization of enamel with biomimetalizing peptide ADP5**

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**Objectives** To develop cell-free remineralization of non-cavitated white spot lesions (WSL) of human enamel with ADP5, an amelogenin-derived peptide.

**Methods** Cervical enamel of extracted human teeth were demineralized for 1.5 weeks in 0.2% acetic acid in 2.2mM CaCl<sub>2</sub> / 2.2mM K<sub>2</sub>HPO<sub>4</sub> solution. Teeth were assigned to 6 groups (n=5 each) and treated either with ADP5 for 30minutes then 48mM Ca<sup>2+</sup>/28mM (PO<sub>4</sub>)<sup>3-</sup> for 2 hours (Group 1), or with ADP5 for 30minutes then 1100ppm F and 48mM Ca<sup>2+</sup>/28mM (PO<sub>4</sub>)<sup>3-</sup> for 2 hours (Group 2), or with 48mM Ca<sup>2+</sup>/28mM (PO<sub>4</sub>)<sup>3-</sup> for 2 hours (Group 3), or with 1100ppm F and 48mM Ca<sup>2+</sup>/28mM (PO<sub>4</sub>)<sup>3-</sup> for 2 hours (Group 4), or with 20,000 ppm F and 48mM Ca<sup>2+</sup>/28mM (PO<sub>4</sub>)<sup>3-</sup> for 2 hours (Group 5), or left with no treatment (Group 6) at 37°C. Samples were prepared for scanning electron microscopy (SEM) for physical analysis of the structure and energy-dispersive X-ray-spectroscopy (EDS) for elemental compositions. The 2-sample t-test power analysis was used to determine sample size.

**Results** ADP5 with Ca<sup>2+</sup>/PO<sub>4</sub><sup>3-</sup> (Groups 1 & 2) showed a continuous layer of at least 10 µm-layer of mineral layer containing nanoscale plate-like calcium phosphate crystals growing from the surface of the underlying porous enamel. The new mineral layer was thick enough to mask the exposed enamel rods. At concentrations of 20,000 ppm F (Group 5), EDS data revealed a large fluoride peak that was twice the size as that of Ca<sup>2+</sup>, indicating the presence of CaF<sub>2</sub> particles. The cross-sectional morphology presented a 5 to 10-µm layer of spherical CaF<sub>2</sub> particles. No new mineral layer was observed in the groups 3 & 6. Group 4 displayed in some areas aggregates of discontinuous CaF<sub>2</sub> particles with exposed enamel rods.

**Conclusions** A continuous layer of plate-like octacalcium phosphate (OCP) and hydroxyapatite (HAp) crystals was observed when ADP5 was applied on artificially induced WSLs on human teeth compared to the conditions, which lacked the biomimetalizing peptide.

0389

#### **Remineralization of partially demineralized dentin using calcium-silicate cements**

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**Objectives** To characterize the remineralization potential of calcium-silicate cements (CSC's) including biomimetic analogs in clinical-like conditions.

**Methods** A class-I dentin cavity was prepared in 24 non-carious third molars. The cavity was coated with a self-etch adhesive (Clearfil SE Bond, Kuraray Noritake), after which a smaller cavity inside was prepared to limit the demineralization area. This area was demineralized using a pH-cycling protocol (50 cyclic immersions in a pH-4.8 and pH-7 bath for 0.5h and 2.5h successively). The cavities were filled with an experimental CSC ('TCS50' containing 50% Ca<sub>3</sub>SiO<sub>5</sub> and 50% ZrO<sub>2</sub>) or the commercial cement Biodentine (Septodont). To half of the specimens, biomimetic analogs (3% polyacrylic acid, 8% sodium tripolyphosphate) were added prior to cement mixing. After 1-week and 6-week storage in phosphate-buffered SBF, the specimens were cross-sectioned and polished using a cross-section polisher (IB-09010CP, JEOL). Interfacial interaction was characterized using a Feg-SEM/EPMA analyzer (JXA-8530F, JEOL).

**Results** pH-cycling partially demineralized dentin (100±20 µm thick). After 1-week storage, both cements were found to have filled interfacial voids and to have deposited CaP precipitates within dentin tubules. Also ZrO<sub>2</sub> was detected 30 µm deep in demineralized dentin in TCS50-filled specimens. No additional interfacial effect by the biomimetic analogs was observed, which may be due to their slow dissolution kinetics. After 6-week storage, tubular occlusion had increased and some indication of initiated intertubular remineralisation was detected at the cement-dentin interface. Adding biomimetic analogs resulted in denser remineralization for both cements. Over time, the cements became more porous, indicating that Ca was transferred to the partially demineralized dentin. **Conclusions** CSC's with biomimetic analogs were shown to have initiated remineralization of artificial carious-like partially demineralized dentin; 6-week however appeared insufficient to achieve significant remineralization of a 100-µm deep partially demineralized dentin layer. Further in-depth structural investigation of the formed CaP precipitates is also needed.

0390

**Effect of Various Remineralization Agents on Incipient Enamel Caries *In-Vitro***

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**Objectives** The aim of this in vitro study was to evaluate the potential of various remineralizing agents to remineralize artificial caries-like lesions on human enamel.

**Methods** Sixty human enamel samples with artificial caries lesions were randomly assigned to each of five groups (n=12) including: 1) Enamel Pro® Varnish (5% sodium fluoride-amorphous calcium phosphate (ACP)); 2) Clinpro™ White Varnish (5% sodium fluoride-tricalcium phosphate (TCP)); 3) Remin Pro (1450 ppm F-hydroxyapatite); 4) R.O.C.S. Remineralizing Gel (calcium, phosphate, magnesium, xylitol); 5) Negative control (distilled deionized water). All enamel samples were painted with acid resistant nail varnish exposing a window of 2x2 mm on the center. The teeth were demineralized by immersion in the demineralization solution at 37°C for 16 hours. The laser florescent device was used to evaluate the presence of demineralization. The test samples were remineralized by once daily application of tested remineralizing agents and then stored in artificial saliva, and incubated at 37°C for 14 days. The negative control samples were left in distilled deionized water during the test period. Degree of remineralization was further assessed with Raman spectroscopy.

**Results** Significantly higher phosphate content within the remineralization groups compared to the negative control group was observed (p<0.05). Group 4 showed highest remineralization whereas Group 1 had lowest. There was statistically significant difference between Group 4 and Groups 1 and 2 (p<0.05).

**Conclusions** All remineralization agents were found effective for treating incipient enamel caries regardless of the fluoride content. Calcium and phosphate containing remineralizing agents might be preferred for enhancing remineralization of white spot lesions.

0391

**Comparative Clinical Evaluation of Diagnosis Efficacy of a New Fluorescence-Aided Diagnosis Method**

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**Objectives** The main objective of this study was to evaluate the efficiency of a new non-invasive fluorescence-aided caries excavation and diagnosis method (ProFACE) in detection of the caries lesions in comparison with conventional methods.

**Methods** After caries excavation was carried out, dentin surfaces were conventionally inspected using visual tactile criteria and 415 cavities which were classified as caries-free, re-inspected with Face-Light and caries detector dye (CDD) methods. Orange-red fluorescing areas classified as carious dentin, as well as stained carious dentin. All the data were recorded according to localization of the caries and determination efficiency of the methods. X<sup>2</sup> test was used to compare the mean values of both Face-Light and dye applications, while Wilcoxon test performed to evaluate the effectiveness for each diagnostic method.

**Results** A total of 273 patients with 415 Class II (OM/OD) cavities (1.65 ± 0.52 teeth per patient) with caries lesions in molar and premolar teeth, were examined. Out of 415 teeth, in 149 teeth (35.9%) no caries findings had been illustrated. While FACE detected remaining carious or partially removed areas in 237 teeth (57.2%), CDD stained only 29 teeth by itself (P<0.05).

**Conclusions** In conclusion, FACE has a higher detectability compared to visual inspection and caries detector dye in diagnosis and removal of carious dentin.



0392

### **Comparison of Different Diagnostic Techniques in Detecting Approximal Caries**

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**Objectives** The aim of this in vitro study was to evaluate the accuracy, sensitivity and specificity of DIAGNOdent pen, Vistacam ix and Bitewing radiography in caries detection of the approximal surfaces of primary molars.

**Methods** For performing the study, 68 primary molars were selected and their approximal caries status was determined using these diagnostic techniques: DIAGNOdent pen, Bitewing radiography and Vistacam ix. The teeth were sectioned and directly assessed by a stereomicroscope as a gold standard. The cut-off points were determined at D1 and D3 according to the Downer histological classification system. The McNemar test was used to compare the sensitivity, specificity and accuracy among the methods.

**Results** Regarding D1, as a cut-off point for histological assessments, sensitivity, specificity and accuracy of DIAGNOdent pen were 0.82, 0.75 and 0.8 respectively, while the values were 0.63, 1 and 0.62 for Bitewing radiography and 0.56, 1 and 0.59 for Vistacam ix.

At the D3 level, as a cut-off point for histological analysis, Sensitivity, specificity and accuracy rates of DIAGNOdent pen were 0.71, 0.86 and 0.8 respectively while these values were 0.71, 0.73 and 0.72 for Bitewing radiography and 0.5, 0.78 and 0.67 for Vistacam ix.

DIAGNOdent pen showed the highest performance and accuracy to detect approximal caries lesions at both D1 and D3 levels among the three methods ( $P < 0.05$ ). Vistacam ix and Bitewing radiography showed significantly better performance at D3 compared to D1 while their performance was lower than DIAGNOdent pen ( $P < 0.05$ ).

**Conclusions** DIAGNOdent pen is the preferred diagnostic technique in approximal caries detection at both the dentine and enamel levels in comparison to Vistacam ix and Bitewing radiography.

0393

### **Evaluating Gene-Environment Interactions In The Etiology Of Dental Caries In Adults: The Cross-Sectional Study**

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**Objectives** Dental caries is a multifactorial disease and can be conceptualized as an interaction between genetic and environmental risk factors. The aim of this study is to examine the effects of AMELX, CA6, DEFB1 and TAS2R38 gene polymorphism and gene-environment interactions on caries etiology and risk assessment in adults.

**Methods** Genomic DNA of 77 adults between 20-60 ages with 'low caries risk group' ( $DMFT \leq 5$ ) and 77 adults with 'high caries risk group' ( $DMFT \geq 14$ ) was extracted from the buccal mucosa. The frequency of AMELX (+522), CA6 (T55M), DEFB1 (G-20A) and TAS2R38 (A49P) single nucleotide polymorphisms (SNPs) were genotyped with the PCR-RFLP method. The environmental risk factors such as plaque amount, toothbrushing frequency, diet frequency between meals, saliva secretion rate, saliva buffer capacity, mutans streptococci counts and lactobacilli counts were examined in the study.

**Results** There was no difference between the caries risk groups in relation to AMELX (+522) gene polymorphism ( $\chi^2$  test,  $p > 0.05$ ). The distribution of CA6 genotype and allele frequencies in low caries risk group did not differ from high caries risk group ( $\chi^2$  test,  $p > 0.05$ ). Polymorphism of DEFB1 (G-20A) was positively and TAS2R38 (A49P) was negatively associated with caries risk ( $\chi^2$  test,  $p < 0.001$ ). There were significant differences between caries susceptibility and each environmental risk factor except saliva secretion rate (Mann-Whitney U test,  $p < 0.001$ ). Based on stepwise multiple linear regression analyses, dental plaque amount, DEFB1 (G-20A) gene polymorphism, lactobacilli count, age, TAS2R38 (A49P) and CA6 (T55M) gene polymorphism and saliva buffer capacity explained a total of 87.8% of the variations in DMFT scores.

**Conclusions** It can be concluded that variation in CA6 (T55M), DEFB1 (G-20A), TAS2R38 (A49P) may be associated with caries experience in Turkish adults when the dental plaque amount, lactobacilli count and age are high and saliva buffer capacity is low.

**0394**

**Evaluation Of Different Diagnostic Methods On Detection Of Incipient Occlusal Caries Lesions**

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**Objectives** The aim of this study was to evaluate the diagnostic performance of laser fluorescence (DIAGNOdent Pen), alternating current impedance spectroscopy technique (CarieScan Pro) and fluorescence camera (VistaProof) with visual examination and histological validation and repeat the examinations by three different examiners and determine the inter-examiner reliability of the detection methods.

**Methods** Extracted 102 human molar teeth were selected. Teeth were embedded in a mold. Visual inspection was performed using ICDAS-II criterias. Then occlusal surfaces were evaluated with DIAGNOdent Pen, CarieScan Pro and VistaProof with three examiners and the datas were recorded. For histological validation, teeth were divided in two from the fissures marked as caries suspected with diamond disk. Each site was examined under a stereomicroscope at magnification of 10X and scored. Diagnostic performances of methods were evaluated with Binormal ROC analysis for D1, D2 and D3 thresholds, the compliance of the datas with histological validations were examined with McNemar-Bowker test and inter-examiner reliability of detection methods was assessed using Cohen's unweighted  $k$  values.

**Results** When the compliance between methods and histological validation was evaluated; first examiner's datas were statistically different with histological validation ( $p < 0,05$ ), second examiner's CarieScan Pro scores and third examiner's visual examination scores were statistically similar ( $p = 0,081$ ). Incipient enamel lesions were determined more successful with visual inspection by three examiners. All detection methods were presented with statistically significant inter-examiner agreement ( $p < 0,001$ ). For D2 and D3 thresholds, VistaProof for first examiner, visual inspection for second examiner and both visual inspection and VistaProof for third examiner demonstrated statistically high sensitivity and specificity ( $p < 0,05$ ).

**Conclusions** Within the limitatons of this study, it can be concluded that diagnostic performance of the methods wasn't enough for detecting incipient occlusal caries lesions by itself so their performances can be improved by using them with visual inspection as a traditional caries detection method.

**0395**

**Managing caries lesions: What we know, what we do and what it means.**

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Based on a changing understanding of dental caries, treatment concepts are modified as well. Both for proximal non-cavitated and deep cavitated lesions, a growing body of evidence supports approaches that are less invasive than conventional care. Within the presentation, this body of evidence will be assessed and put into the perspective of modern caries management strategies. Research and clinical practice data will be contrasted and possible reasons for a discrepancies between evidence and clinical care provision will be evaluated and discussed. Eventually, the long-term implications of different treatment strategies will be demonstrated and options for implementing less invasive treatments for dental caries in general practice will be outlined.

**Initial testing failures in shear bond strength tests**Schedle, A.<sup>1</sup>, Lettner, S.<sup>2</sup>, Franz, A.<sup>1</sup><sup>1</sup>University Clinic of Dentistry, <sup>2</sup>University Clinic of Dentistry

**Objectives** The aims of the present study were to evaluate the occurrence of initial testing-failures (specimens broke spontaneously or adhesion was too low to be registered) of four self-etching-bondings and a three-step etch-and-rinse-bonding and to analyse the impact of different air-drying techniques.

**Methods** The experiments were performed by dental students during their regular courses (2008-2014). The dentin bond strength of four self-etching (Optibond-All-in-One, [OBAIO, 2008-2014] Kerr; XenoV [XV, 2008-2010], Dentsply; XenoV<sup>+</sup> [XV<sup>+</sup>, 2011-2014], Dentsply; Optibond XTR [OBXTR, 2012-2014], Kerr) and of a three-step etch-and-rinse-system (Optibond FL, [OBFL, 2008-2011], Kerr) was tested. 234 (2008), 223 (2009), 209 (2010), 231 (2011), 234 (2012), 252 (2013) and 234 (2014) composite-cylinders were fixed on bovine teeth with the tested bonding-systems perpendicular to the exposed dentin surfaces. Half of the specimens were subjected to thermocycling (2008-2010). The air-drying protocol varied (evaluated with an anemometer): 2008 bondings were air-dried with bellows, 2009 with high-pressure compressed air and 2010-2014 with low-pressure compressed air. 2011-2014 the supervision of the students was further optimized. Shear-tests were performed with an universal testing-machine (Zwick). Data were analysed by mixed effect logit regression including thermocycling, system and year as fixed effects and student ID as random effect.

**Results** The occurrence of failure was highly system dependent both for an overall comparison as well as within most of the years with p-values well below 0.01. Thermocycling had a significant influence on the occurrence of failure overall, but not on a within-year level. Both over-all and within years XV and XV<sup>+</sup> showed a significantly higher percentage of testing-failures versus all other systems (OBAIO, OBFL, OBXTR). Least testing-failures were observed with OBFL and OBXTR.

**Conclusions** This study shows that the occurrence of initial testing-failures depends on the applied technique of air-drying and that the multi-step systems (OBFL, OBXTR) showed least initial testing-failures in the hands of inexperienced experimentators independently of the respective air-drying technique.

**Initial testing failures**

	2008	2009	2010	2011	2012	2013	2014
OBFL	17.4%	4.3%	5.7%	0%			
OBXTR					3,8%	2%	1%
OBAIO	30.5%	8.6%	18.8%	2.6%	10.3%	8%	1%
XV	56.6%	73.5%	30%				
XV <sup>+</sup>				22.1%	33.3%	45%	15%

**0397**

**Effect of photo-initiator on long-term mini-interfacial fracture toughness of adhesives**

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**Objectives** To evaluate the effect of the kind/concentration of photo-initiator on the mini-interfacial Fracture Toughness (mini-iFT) to dentin at 1 week and 6 months.

**Methods** Clearfil S3 Bond Plus (C-S3P) and 4 derived experimental adhesives (Kuraray Noritake) containing 2.0wt% camphorquinone(CQ) and 2.0wt% EDMAB ('LUB-CQ\_high'), 0.35wt% CQ and 0.35wt% EDMAB ('LUB-CQ\_low'), 2.0wt% TPO ('LUB-TPO\_high'), and 0.35wt% TPO ('LUB-TPO\_low') were applied to 320-grit SiC-paper ground dentin, cured (Bluephase 20i, Ivoclar-Vivadent: "high mode") for 10 sec and covered with composite (Z100, 3M ESPE). The restored teeth were cut in sticks (1.5x2.0x16mm), after which a single-gradient notch was prepared at the adhesive-dentin interface using a 150-µm diamond blade. Specimens were kept in distilled water at 37°C for 1 week or 6 months before testing. The mini-iFT specimens were loaded until failure in a 4-point bending test and KiC was calculated. All fractured specimens were processed for scanning electron microscopy (SEM).

**Results** The characteristic strength and Weibull modulus increased with higher photo-initiator concentration. The mean mini-iFT was stable over time, but Weibull's modulus tended to decrease after 6 months. At high concentration, mean mini-iFT of CQ and TPO were similar, though CQ showed lower variability than TPO. SEM revealed that a high photo-initiator concentration was associated with more frequent failures at the hybrid-layer top, versus more frequent failures towards the hybrid-layer bottom for a low photo-initiator concentration.

**Conclusions** Increasing the photo-initiator concentration significantly increased the bonding effectiveness and reliability. After 6-month aging, the mini-iFT values remained stable, though varied more.

**0398**

**Bond strength, microleakage and EDS evaluation of three different adhesives**

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Yeditepe University

**Objectives** The aim of this study was to compare the bond strengths and microleakages of two fluoride-containing and one fluoride-free adhesive systems and evaluate the cavity restoration interfaces with Energy Dispersive Spectrometry (EDS) analysis.

**Methods** 51 caries-free premolars were used for this study. 39 Class V cavities were prepared on the buccal surface for microtensile test and EDS analysis. The teeth were divided into 3 groups and restored with 3 different adhesive systems and a composite resin (AdheSE One F, Clearfil SE Bond, FL Bond II and Filtek Z250). After 1000 thermal cycles, microtensile test was performed on 30 teeth (0.5 mm/min, Instron) (n=20). 9 teeth stored in distilled water 37°C dessicator for 30 days (n=3) were selected for EDS analysis. 12 Class V cavities were prepared on both buccal and lingual/palatal surfaces for microleakage. Teeth were immersed in 0.5% basic fuchsin for 24 hours (n=8) and evaluated for microleakage test. Data was analyzed by 'One-way ANOVA', 'Tukey HSD' tests, 'Freeman Halton test', 'Ki-square test' and 'Exact Ki-square' tests.

**Results** FL Bond II showed significantly lower bond strengths than Clearfil SE Bond and AdheSE One F ( $p < 0.01$ ) while there were no significant differences between Clearfil SE Bond and AdheSE One F. For microleakage results, there were no difference between the groups and occlusal/gingival margins of the same groups. In SEM evaluation for EDS analysis, there were no fluoride ions in the adhesive layer and the adjacent dentine restored with Clearfil SE Bond and AdheSE One F. However, fluoride ions were only observed in the adhesive layer of FL Bond II group.

**Conclusions** Although fluoride ions were detected in the adhesive layer of FL Bond II group, generally fluoride containing adhesives did not significantly improve the bond strength values and did not affect microleakage.

0399

#### **Microleakage of Indirect Resin Composite Luted with Different Adhesive Cements**

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**Objectives** To evaluate the influence of different adhesive cements on the microleakage of proximal surfaces in class II indirect resin composite restorations.

**Methods** Twenty-four human extracted caries-free third molars were selected. Standard class II cavities were prepared on the mesial and distal surfaces with margins located below the CEJ. Cavities were standardized by fixing the handpiece in a parallelometer during preparation. Treatment groups were divided into 4 cements: GCem (GCm) (GC, Japan), Panavia F 2.0 (P) (Kuraray, Japan), RelyX U 200 (Rx) (3M ESPE, USA), Superbond C&B (SB) (SunMedical, Japan) and control (V) (Variolink II, Ivoclar Vivadent,). In each tooth, the mesial cavity was set as the experimental and the distal as a control. Restorations were fabricated with an indirect composite resin (Gradia; GC) and luted into cavities. Specimens were thermocycled (5-55°C, 5000 cycles) and immersed in 50% silver nitrate solution for 24 hours. The teeth were sectioned mesiodistally and evaluated for microleakage using digital image analysis (24x; Leica optical microscope). The ordinal scale used was: 0-4 (0= no microleakage and 4= dye penetration along axial wall). Mean values for each group were recorded and statistically analyzed using Wilcoxon Signed Ranks Test ( $\alpha=0,05$ ).

**Results** There were no significant differences among occlusal microleakage of all groups (GCm:0; P:  $0,17\pm0,4$ ; Rx:0 and SB: $0,17\pm0,4$ ) ( $P>0,05$ ). The least microleakage ( $\mu\pm SD$ ) was recorded for GCm and Rx self-adhesive cements for occlusal (0,00; 0,00) and gingival ( $0,83\pm0,4$ ;  $0,50\pm0,5$ ) parts, respectively. The highest microleakage was noted with SB and P at the gingival parts ( $2,0\pm1,4$ ;  $1,5\pm0,84$ ), respectively and the difference was significant compared to the other groups ( $P<0,05$ ).

**Conclusions** Tested self-adhesive dual-curing resin cements exhibited simulated long-term microleakage stability while self-curing resin cement yielded highest microleakage.

0400

#### **A Comparison Of The Different Self-Adhesive Composites' Shear Bond Strength On Caries Affected Dentin With Using Er-Yag Laser**

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**Objectives** The aim of this study was to evaluate of different self-adhesive composites' shear bond strength when used different adhesive systems on affected caries dentin with using Er-YAG Laser.

**Methods** 220 decayed molar teeth, were randomly divided in two groups to be used in two different removing methods (Er-YAG, bur). Then teeth were divided further into nine subgroups in each group ( $n = 10$ ) to be applied different adhesive systems (SE Bond, OptibondFL) with different self-adhesive composites (VertiseFlow, Constic, FusionLiquidDentin). The control group consisted of a flowable conventional composite (FiltekUltimateFlow) were performed with two different adhesive system. Adhesive systems and composites were applied on caries affected dentin according to manufacturer's instructions. Shear bond strength test was applied on teeth. The Kruskal-Wallis, One way Anova and Mann-Whitney U and Wilcoxon rank tests were applied ( $p= 0.05$ ) to have a statistics of the obtained data.

**Results** According to the results, the differences were detected between caries removal methods and composites of shear bond strength test ( $p < 0.05$ ). Caries removing methods of bur groups obtain the highest shear bond strength values than Er:YAG Laser groups (except groups which self adhesive composites applied alone). Generally, all of the self-adhesive composites showed similar bond strength values ( $p < 0.05$ ), traditional flowable composite showed higher values than self adhesive composites ( $p > 0.05$ ). Self-adhesive composite applied groups showed significantly lower bond strength values according to the groups with the adhesive system applied ( $p < 0.05$ ), there was not significantly difference between self-etch and total-etch adhesive ( $p > 0.05$ ).

**Conclusions** Self-adhesive composites, showed lowest bond strength values than the control groups and groups which self-adhesive composites applied with adhesive systems. According to the results of this study, self-adhesive composites' application solitary is not recommended.

**0401**

**Microleakage of High Filler Flowable Composite in Primary Molar Restoration**

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**Objectives** The purpose of this in vitro study was to evaluate and compare the microleakage of class II cavities restored with nanohybrid high filler flowable composite and universal composite using total etch and self etch bonding systems.

**Methods** Standard class II cavities were prepared on 48 extracted primary teeth and the gingival seat was located 1mm above the cemento-enamel junction and the teeth were randomly divided into four subgroups restored with Grandioflow with Futurabond M, Grandio with Futurabond M, Grandioflow with Solobond M, Grandio with Solobond M. Restorations were finished and stored in distilled water at 37°C for 24 hours and then subjected to thermocycling. All the teeth were sealed with nail varnish, placed in silver nitrate solution and then vertically cut in mesiodistal direction. Subsequently the specimens were evaluated for gingival microleakage using a stereomicroscope. Data were analyzed using two-way ANOVA and Monte Carlo method.

**Results** Results of this study showed no significant difference among the groups ( $P=0.056$ ) and binary comparison of the groups showed that Grandio with Solobond M and Grandioflow with Solobond M differed marginally ( $p=0.055$ ).

**Conclusions** From Microleakage point of view it seems reasonable to use self etch bonding agents and Grandioflow composite. Combination of Self etch bonding agent - Grandioflow composite are easier to apply compared to universal Grandio composite-total etch bonding agents, actually self etch bonding agent-flowable composite could reduce treatment time which is of great importance in pediatric dentistry.

**0402**

**Community Dental Caries Risk Profiles And Health Policy**

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**Objectives** To assess the distribution of caries frequency based on age groups and determine the community risk profiles of dental caries that can be effective on health policy in terms of preventive strategies.

**Methods** This study is a part of an oral health surveillance analysis project, being conducted on 3040 individuals from 2009-2010. Main sample group of the survey was determined with stratified proportional random sampling strategy according to distribution of demographic data, age, gender, rural and urban area by using SPSS programme (Sample power 95%). Clinical examinations were done by three calibrated dentists with the aid of Q-Optics Radiant Light System Headlight having 91500 lux power by using plane mouth mirror and probe after teeth were dried with cotton rolls.

**Results** It has been determined that DMF-S generally increases with age. The age groups between 10-14 ; DMF-S is 10.40 . And for the age group of 15-19; it is 9.65. It is seen that distribution of dmft or DMF-T is in very large scale. For example in the 30-39 years of age group dmft and DMF-T spread from 0 to 34 . This minimum and maximum value is very different from the mean of the all group which is 15.68. There are statistically significant differences between the mean of all group dmft and DMF-T and the mean of the subgroups of caries frequency in the same age. On the other hand, the percentage of people has dental caries respectively between 0.1-0.99 DMF-T , 2-2.99 DMF-T, 5-5.99 DMF-T are 19.6 , 2.3, 1.7 at the 10-14 years of age.

**Conclusions** Oral health promotion program depends on needs of caries risk groups. The mean of dmft and DMF-T score at the same age groups does not give us any information about the community risk profiles. Nevertheless the caries risk frequency informs us of which people are placed in the caries frequency groups also which preventive measures should be applied.

0404

**Factors Affecting Patients Choice of their Dentist , and Reasons For Change . A Cross-sectional Study in Qassim Region**

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**Objectives** This Study is aimed to determine the factors influencing patients choice of their dentists, evaluating priorities of people and reasons beyond changing dental office .

**Methods** 562 persons of various age groups from Qassim province were participated in the Study . Subjects were asked to to prioritize selective criteria in a 20 -items questionnaire for the most important factors in dentist choice and in second part they were asked to determine which reasons beyond changing dentists .

**Results** The results revealed that the most important factors in choosing dentist are the dentist experience , qualifications and specialization in particular illness . Dentist misbehave and Many other factors were important beyond changing dentists .

**Conclusions** Dentists must be aware of which factors attract and satisfy their patients .The results of the present study suggest that the factors patients perceive as most important to their choice of a dentist is the dentist's professional skill and experience .

Dentists' effective behavior including interest, gaining patient trust , and good communication skills correlated positively with patient satisfaction in a consultation .The Quality and effectiveness of oral health providers should meet and satisfy patients needs beside their communication skills .

Mean Score for most important factors among study population

Item	Mean
How long the dentist has been practicing	4.24
Whether the dentist is board certified	4.03
Specialization in a particular illness	4.00

Mean Score for least important factors among study population

Item	Mean
The dentist's marital status	2.11
The dentist's age	2.55
The dentist's gender	2.62

0405

**" Correlation between xerostomia and OHRQoL of the Indonesian elderly "**

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**Objectives** To correlate between xerostomia and oral health-related quality of life (OHRQoL) of the Indonesian elderly.

**Methods** A total of 93 elders ( $\geq 60$  years) from five elderly communities in Yogyakarta Indonesia were conducted xerostomia assessment using Xerostomia Inventory (XI). While OHRQoL was determined using Geriatric Oral Health Assessment Index (GOHAI) questionnaire that was classified based on total score of GOHAI ( $\leq 50$  : low, 51-56 : moderate, 57-60 : high). The correlation between xerostomia and OHRQoL was analysed using Pearson Product Moment Correlation.

**Results** Forty four of 93 (47.3%) elders experienced xerostomia. High, moderate and low OHRQoL were experienced by 11 (11,8%), 16 (17,2%), 66 (71%) of 93 elders, respectively. A strong, negative correlation was detected between xerostomia and OHRQoL with a correlation coefficient of -0.534 ( $p = 0.000$ ).

**Conclusions** The higher the severity of xerostomia the lower the OHRQoL of Indonesian elderly in Yogyakarta.

0406

**Salivary urea predicted longevity in frail elderly referred to acute care hospital**

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**Objectives** Malnutrition and inflammation are highly prevalent and closely related in frail elderly and are strong risk factors for mortality. When acute infections occur in frail elderly, both inflammation and malnutrition coincide and this combination increases the risk of mortality even higher. Protein intake assessed by albumin or urea was anti-inflammatory and reduced VCAM-1 and CRP levels. We hypothesized that salivary urea (sal-urea) as a marker for protein intake will be associated with lower risk of mortality.

**Methods** We analyzed data from 103 old-old frail elderly (median age=82, Interquartile range=80-85) who were referred to an acute-care hospital and examined whether protein intake assessed by sal-urea was associated with all-cause mortality. The patients' oral health was examined clinically and radiographically in the hospital and whole saliva samples were collected and analyzed for urea (Boehringer MPR-2 kit). We used multivariate proportional hazard modeling with all-cause mortality as the outcome and sal-urea as the predictor adjusting for age, sex, smoking, edentulism, hospitalization with acute illness, and serum CRP.

**Results** In 12 years of follow-up, 65 all-cause mortalities were accrued among 103 patients. Protein intake markers (sal-albumin and sal-urea) were significantly and inversely associated with mortality but sal-urea was more robust with Hazard ratio (HR) 0.89 (95% confidence interval: 0.80 - 0.99) and  $p=0.03$ . The patients' oral health parameters such as number of teeth, edentulism, deep caries, pericoronitis, periapical lesions and number of furcation were not significantly associated with mortality.

**Conclusions** salivary urea levels were inversely associated with all-cause mortality among the old-old elderly supporting our hypothesis that high protein intake may be beneficial for survival in frail elderly with acute illness. In this study, only age and sal-urea were the significant predictors for mortality and CRP was not: suggesting that in old-old cohorts, nutrition may be more important than inflammation (HR for CRP=1.15,  $p=0.61$ ).

0407

**HMGB1-Protein as a possible marker to identify side effects in periodontal remodeling following mechanical loading**

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**Objectives** High-mobility-group-box-protein 1 (HMGB1) is released into the extracellular milieu by damaged PDL-cells and functions as an alarmin to mediate the inflammatory host response and regulate periodontal remodeling. Recent studies indicated that a fail regulation of released HMGB1 during periodontal remodeling can lead to an immune over reaction resulting in the destruction of dental tissues. Therefore, it was the aim of the present investigation to further analyze the distinguish role of HMGB1 within the periodontal remodeling process following mechanical loading. We hypothesized that, due to its immunological function, HMGB1 is capable to function as a diagnostic protein to identify negative side effects mechanical loading.

**Methods** HMGB1 expression by cultured human PDL-cells and of orthodontically treated rats was analyzed by means of immunocytochemistry/ELISA. The influence of HMGB1 secreted by PDL-cells on macrophage physiology was investigated by migration and osteoclastic differentiation assays. To transfer these findings to the clinical side, orthodontically treated patients were analyze for tissue HMGB1 expression within the crevicular fluid and correlated with excessive bone removal/root resorption.

**Results** Induction of mechanical stress *in vivo* and *in vitro* resulted in enhanced HMGB1 protein expression and an intracellular translocation of HMGB1 in the initial phase of tissue repair. Migration and osteoclastic differentiation of human macrophages is regulated by PDL cell expressed HMGB1. Side effects in clinical orthodontic treatment by means of bone removal or root resorption was accompanied with an increase in crevicular fluid HMGB1 protein expression.

**Conclusions** These data clearly point to a possible role of HMGB1 in periodontal tissue repair with an immune modulatory function when acting in concert with other cytokines in mechanical induced tissue remodeling. High levels of HMGB1 in crevicular fluid seem to be a possible marker to identify side effects of mechanical loading induced tissue remodelling and orthodontic treatment. These findings extend the basis for possible prevention and therapeutical intervention strategies for tissue damage that might occur in the course of orthodontic treatment.



0408

**Survival of Gingival Epithelial Cells Infected by *Porphyromonas gingivalis***

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**Objectives** Controversial results are available in the literature regarding the effect induced by *Porphyromonas gingivalis* (*Pg*) on epithelial cell apoptosis and proliferation. The aim of this study was to investigate apoptosis related gene expression in epithelial cells infected with *Pg*.

**Methods** Gingival epithelial cells OKF6 TERT2 (GECS) were infected with *Pg* ATCC 33277 at a multiplicity of infection (MOI) of 10, 100 and stimulated by *Pg* lipopolysaccharide (LPS). Cell proliferation was evaluated using Alamar Blue, proliferation assays and wound-healing assay. Cell death was measured using LIVE-DEAD and Annexin V-propidium iodide staining at 24, 48 and 72 hours. At 24 hours, mRNA expression analysis was performed by RT-q-PCR for Caspase 1, 3 and 9, BAX-1, BCL-2, Apaf-1 and keratin 10.

**Results** Infection with *Pg* (100 MOI) induced a significant increase in GECS viability and proliferation in comparison with other tested conditions at all time-points. A significant decrease in both levels of apoptosis and necrosis was observed. *Pg*-LPS increased also proliferation at 24 hours. The increase of viability was correlated to a significant decrease of mRNA expression for Caspase 1, 9, Bax-1, Apaf-1 and an increase in BCL-2 and Keratin10.

**Conclusions** *Pg* infection related effects appear to be dose-dependent and inhibit epithelial cell death, through increase of cell viability and proliferation rate. These results showed that *Pg* is able to block cell death apoptosis to promote its own survival and is mainly involved in inhibiting apoptosis but also affecting the levels of infected cells necrosis.

0409

**p53 regulation under inflammatory and hypoxic conditions in the human periodontium**

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**Objectives** p53 is an important tumor suppressor protein, which is also involved in apoptosis induction, autophagy or oxidative stress. Inflammation and hypoxia lead to an increase of p53 protein levels. However, the involvement of p53 in oral inflammatory processes is not well known. Therefore, effects of hypoxia and bacterial induced inflammation on p53 regulation in human periodontal ligament (PDL) cells *in vitro* and its occurrence in healthy and diseased periodontal tissues were investigated.

**Methods** Primary PDL fibroblasts from healthy human premolar teeth were stimulated with lipopolysaccharides (LPS) from *P. gingivalis* under normoxic and hypoxic (1% O<sub>2</sub>) conditions *in vitro* to simulate periodontal inflammation. Cell viability, p53 mRNA expression, protein synthesis and p53 activation were measured using a cell proliferation kit, quantitative RT-PCR, immunoblotting and immunofluorescence after 2, 4, 8, 24 and 48 h. Additionally, immunohistochemical staining of p53 was done on sections from paraffin embedded healthy and diseased periodontal tissues of 20 patients (gingivitis, periodontitis, periimplantitis).

**Results** LPS stimulation initially induced a significant upregulation of p53 mRNA expression and an increase of protein level. It also led to nuclear translocation indicating p53 activation. After 24 h of stimulation, a significant reduction of the expression rate and protein level were observed. Hypoxic stimulation alone nearly had no effects, but PDL cell viability was improved. The combination of LPS stimulation and hypoxia reduced cell viability after 24 h compared to viability under hypoxia alone. Immunostaining revealed a stronger and more widespread p53 immunoreactivity in specimens obtained from patients with periodontitis compared to those with gingivitis and periimplantitis.

**Conclusions** The data indicate that p53 plays a pivotal role in PDL cell homeostasis. It is probably involved in the pathogenesis of periodontal inflammation and regulated by LPS and hypoxia. p53 may be responsible for LPS induced inflammatory apoptosis in the PDL.

**0411**

**Effects of melatonin on oxidative stress in brain tissue after experimental periodontitis in rats**

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**Objectives** The purpose of this study was to evaluate the effects of melatonin on the oxidative status in brain tissue after experimental periodontitis in rats.

**Methods** Thirty Wistar Albino male rats were used and divided into four groups as follows: healthy + saline solution (Hs, n=7), healthy + melatonin (Hm, n=7), periodontitis + saline solution (Ps, n=8) and periodontitis + melatonin (Pm, n=8). Experimental periodontitis was induced with ligature placed at the gingival margin of the maxillary second molars. Melatonin was applied 10 mg/kg per day intraperitoneal for 2 weeks. After sacrifice, malondialdehyde (MDA), superoxide dismutase (SOD), and glutathione peroxidase (GSH-Px) levels were evaluated in the brain tissue.

**Results** GSH-Px levels were higher, MDA levels were lower in the Hm groups than in the Hs groups. The Pm group had lower MDA levels and higher GSH-Px levels than those in the Ps group. SOD levels were similar among the groups.

**Conclusions** Melatonin may be considered as a potential agent against oxidative damage in periodontitis and brain disease by reducing lipid peroxidation.

**0412**

**The role of polymorphonuclear neutrophils in the healthy oral cavity**

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The equilibrium characterizing oral health is maintained by the interplay between the microbiome and the host immune factors. Polymorphonuclear neutrophils (PMNs) are first-line defense immune cells, originating from the circulation and readily accessible in the oral fluid. Current knowledge of PMNs is largely based on circulatory PMNs (cPMNs) and less is known about the contribution of the oral PMNs (oPMNs) to oral health maintenance. We present data on the phenotype (cell counts, viability, cell cycle analysis, degranulation, ROS production) of oPMNs and compare them to circulatory PMNs. In a large group of orally and systemically healthy young individuals, we found that although oPMNs appear to be further towards the end of their life cycle compared to cPMNs, a large proportion of oPMNs are viable and functional, as demonstrated by high levels of degranulation and ROS released in reaction to bacterial stimulation. Learning objective is to learn that the PMNs maintain their potential to perform antibacterial functions also outside blood, in the oral cavity, which might be protective at the interface between the oral biofilm and the oral mucosal barrier.

**0413**

**Inter-individual variation, correlations and sex-related differences in the salivary biochemistry of young healthy adults**

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**Objective:** A cross-sectional observational study was conducted to evaluate inter-individual biochemical variation in unstimulated whole saliva in a population of 268 systemically healthy young students, 18-30 yr of age, with no apparent caries lesions or periodontal disease. **Methods:** Salivary flow rate, protein content, pH, buffering capacity, mucins MUC5B and MUC7, albumin, secretory IgA, cystatin S, lactoferrin, chitinase, amylase, lysozyme, and proteases were measured using ELISAs and enzymatic activity assays. Principal component analysis (PCA) and spectral clustering (SC) were used to assess inter-variable relationships within the data set and to identify subgroups. **Results:** Significant differences were found between male and female subjects. Salivary pH, buffering capacity, protein content, MUC5B, secretory IgA, and chitinase activity were all lower in female subjects compared with male subjects, whereas MUC7 and lysozyme activity were higher in female subjects. There was no significant difference between sexes in salivary flow rate, albumin, cystatin S, amylase, and protease activity. Spectral Clustering identified two clusters of participants, which were subsequently described. **Conclusion:** This study provides a comprehensive overview of the distribution and inter-relations of a set of important salivary biochemical variables in a systemically healthy young adult population, free of apparent caries lesions and periodontal disease. It highlights significant gender differences in salivary biochemistry.

0414

**A new compound that prevents development of the cariogenic potential of dental plaque**

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**Introduction**Caries is the most common oral disease in the world. The production of acids by oral biofilms causes demineralisation of the enamel, ultimately resulting in caries lesions. In this study we used in vitro oral microcosm biofilms to screen the effect of a series of natural and synthetic compounds on lactate production by and microbial composition of biofilms.**Methods**Oral biofilms were grown in the Amsterdam Active Attachment model for 2 days, using buffered McBain medium with 0.2 % sucrose. Pooled stimulated saliva was used as inoculum. A selection of 5 natural and synthetic compounds was added up to 100 µmol/L and compared to untreated control biofilms. Lactate production and protease activity was assayed as surrogates for cariogenic and periodontal behaviour respectively. The community composition of the biofilms was determined using 16S rDNA sequencing.**Results**The microcosm biofilms reached up to 10<sup>9</sup> CFUs irrespective of presence of the compounds. In addition, proteolytic activity remained unchanged. In contrast, a dose-dependent reduction in lactate production was observed for biofilms grown in the presence of one of the compounds. 16S rDNA sequencing revealed that the abundance of *Streptococcus* spp. was significantly reduced in the presence of this compound while *Veillonella* spp. and *Actinobacillus* spp. became more abundant.**Conclusion & Discussion**We identified a compound that has the potential to reduce the cariogenic properties of in vitro oral microcosm biofilms in a dose-responsive manner, without apparent antimicrobial activity.

0415

**Relation Between Salivary Microbiome and Host-related Parameters In Healthy Adults.**

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**Objectives**Individuals can vary significantly in the oral microbiome composition. Through the application of next generation sequence analysis, detailed information is to be gained on the composition and functional characteristics of the microbial ecosystem. A better insight in the boundaries of the inter-individual variation of the salivary microbiome and its relation with biochemical parameters will result. This study explores a possible relationship with oral health and oral function.**Methods**Unstimulated saliva was collected from 267 individuals. After DNA isolation, the V4 hypervariable region of the 16S rRNA gene was amplified and sequenced using paired-end technology on the Illumina MiSeq platform. Sequencing data was processed to OTUs using mothur. Based on their OTU profiles, individuals were clustered using the unsupervised Spectral Clustering algorithm. For statistical analyses the data was pre-filtered at an abundance of 10<sup>-5</sup> reads/OTU and subsampled. Elastic Net with Stability Selection, a supervised method, was used to uncover biomarkers (OTUs) that correlated with biochemical parameters.**Results**The relationships between the individuals, their salivary microbiome, and biochemical parameters were delineated in two ways. The Spectral Clustering of the individuals resulted into three groups, where the largest group could be subdivided into three groups based on taxonomic composition. These groups showed differences with respect to species composition, diversity and several biochemical parameters, such as albumin and lysozyme. In addition, these groups differed in, for example, plaque index and salivary pH. Next, several biochemical parameters, including salivary pH were used to delineate biomarkers (OTUs) using the Elastic Net algorithm. This showed several OTUs that had a high probability of being selected as 'biomarker'.**Conclusions**The analysis of the salivary microbiome in relation to biochemical parameters showed that healthy individuals can be clustered in distinctive groups with differences in salivary biochemistry. The importance of the uncovered biomarkers related to, for example, salivary pH is to be further analysed.

0416

#### A COMPARISON OF DIFFERENT TYPES OF LASER ACTIVATED IRRIGATION WITH CONVENTIONAL AGITATION TECHNIQUES

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**Objectives** The aim of this study was (1) to compare the efficacy of conventional syringe (CS), ultrasonic (US), manual-dynamic (MDI), and laser activated irrigation (LAI) with 2,940-nm Er:YAG laser in removing debris from simulated root canal irregularities in natural teeth and root canals in transparent resin blocks; and (2) to validate this resin root canal model for the model's intended purpose.

**Methods** Twenty-five straight lateral incisor roots were embedded in resin and their canals prepared to a standardized shape (.06 taper, MAF ISO 40). The roots were split longitudinally, and a standardized groove was prepared in the apical part in the root canal wall of 1 part. Each natural root was used no more than six times. The dimensions of the root canals in the resin models were identical. The grooves were filled and compacted with 0.3mg dentine debris. Each experimental method was repeated 20 times (n=20). Canals were filled with 2.5% sodium hypochlorite and six irrigant activation procedures were tested: CS, MDI, US, LAI with X Pulse tip 400/14 inside the canal (Er-XP-in), LAI with a PIPS tip 400/14 at the canal entrance (Er-PIPS), and LAI with X Pulse tip 400/14 at the canal entrance (Er-XP-out). Laser settings were: 20 mJ, 20 Hz and 50µs. The amount of remaining debris in the groove was scored and compared among the groups using non-parametric tests.

**Results** CS removed significantly less debris than all other groups (p<0.05). Significantly more debris was removed in both Er-XP-in and US groups than in the CI, MDI, Er-PIPS and Er-XP-out groups (p<0.05). The findings were similar in both natural roots and in the resin-root-model (p>0.05). No statistically significant differences were found between identical irrigation methods in both natural roots and the resin model (p>0.05).

**Conclusions** Laser activated irrigation is a valuable alternative for ultrasonically activated irrigation. The resin root canal model is a validated alternative for human roots for this type of investigations.

0417

#### The effect of various preparation sizes on root canal preparation with the use of four rotary systems

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**Objectives** To evaluate the effect of preparation sizes on canal transportation, canal curvature, centering ratio and volumetric changes with the use of four rotary systems in severely curved canals using cone-beam computed tomographic (CBCT).

L dsgner L drmat bb`kqnsb`m`kr ne 5/ 1 `ne.Ât k`qetrs l nk q`v hsg`m`nfkd ne bt qu`st qd q`nf lmf eqnl 1/ °34° were divided into four groups. CBCT images obtained before the canal preparation to balance the groups with respect to the angle and to compare the root canal preparation. Root canals were then shaped with following system to the apical size of 40 according to the groups; ProTaper Next (Dentsply, Maillefer, Ballaigues, Switzerland) ProTaper Gold (Dentsply, Tulsa Dental Specialties, OK) Revo-S (MicroMega, Besancon, France) , BioRace (FKG, La Chaux-de-Fonds, Switzerland). After each instrument the amount of canal transportation, centering ratio, canal curvature and volumetric changes that occurred were assessed by using CBCT image. The images were three dimensionally reconstructed by *Mimics* software. Volumetric changes were calculated by software, canal curvature differences were calculated by the method *Estrela et al.* described before. The canals were sectioned horizontally at 1,3,6 and 9 mm from the apex. The significant level was set at  $P=0.05$ .

**Results** File size did not significantly affect transportation and centering ratio ( $P > 0.05$ ) and significantly affected canal curvature and volumetric changes ( $P < 0.05$ ) irrespective of rotary systems. There were no significant differences in canal transportation and centering ratio between rotary systems at any apical sizes ( $P > 0.05$ ). With the apical size of 25, BioRace significantly maintained original canal curvature better than the other systems ( $P < 0.05$ ). At the apical size of 30 and 40, Revo-S and ProTaper Gold significantly respected the original canal curvature respectively ( $P < 0.05$ ).

**Conclusions** Based on the present findings, file sizes affected canal curvature and volumetric changes for all rotary systems.

0418

**Comparison of the amount of apically extruded debris during retreatment using different Ni-Ti systems and hand instruments in teeth with open apices**

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**Objectives** The purpose of this study was to compare the apically extruded debris during retreatment procedures in teeth with open apices using hand instruments, rotary instruments with continuous rotation and reciprocation. **Methods** Forty-five single-rooted maxillary incisors and canines were used in this study. The root tips were dissected to simulate teeth with open apices and enlarged using Gates Glidden burs. After root canal shaping and filling using AH Plus and gutta-percha, the teeth were randomly divided into 3 groups (n=15). Retreatment was performed using the following systems in each group: Group 1: ProTaper Retreatment instruments using continuous rotation + ProTaper Universal files Group 2: K-type hand files Group 3: Reciproc files using the reciprocating motion. The extruded debris was collected in glass vials. The weight of the collecting vials was measured before and after instrumentation using a microbalance and the difference was recorded as the amount of extruded debris. The data were statistically analyzed using Kruskal Wallis and Bonferroni corrected Mann Whitney U test. **Results** Statistical analysis showed that the amount of extrusion was significantly less in rotary systems compared to the hand instruments (p: 0.001) and reciprocating systems ( p: 0.001). On the other hand, the amount of extrusion in the reciprocating group was significantly lower compared to the hand instruments (p:0.009; p<0.017). **Conclusions** The amount of extrusion in Ni-Ti instruments using a continuous rotation was significantly lower compared to hand instruments and Ni-Ti instruments using a reciprocating motion in teeth with open apices.

0419

**Ability of Different Obturation Techniques to fill Canal Irregularities Using Gutta-Percha and Resilon**

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**Objectives** This study aimed to test the ability of gutta-percha and RealSeal to fill canal irregularities using different obturation techniques. **Methods** A split-tooth model with four artificially created defects on canal wall was used to compare three techniques, cold lateral (CLC), warm lateral (WLC), and warm vertical (WVC) used with gutta-percha and RealSeal obturating materials. The technique evaluation was based on defect replication quality as a function of defect location and size. Obturation mass was removed for visual evaluation on an ordinal scale, 0 to 4, based on how much each defect was replicated. Statistically analysis was performed using Kruskal-Wallis test and pairwise comparisons were analyzed with Mann Whitney test. **Results** Both warm techniques were significantly better than CLC. Based on defect sites, WVC was better than WLC in replicating the apical defect. However, there was no significant difference between replicating small and large middle defect for the two warm techniques. no significant difference was found between gutta-percha and RealSeal in all defect sites using WLC and WVC. **Conclusions** Both gutta perch and RealSeal are similarly replicate canal irregularities when used with worm techniques.

0420

# **Vertical root fracture resistance of simulated immature permanent teeth filled with MTA with different vehicles**

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**Objectives** To examine the vertical root fracture (VRF) resistance of immature permanent teeth roots filled with MTA mixed with different tracers.

**Methods** Forty extracted human single rooted mandibular premolars, with straight root canals were selected. The teeth were decoronised and root apices were removed to obtain 9 mm roots in length. Root canals were enlarged with rotary files while the root apices were enlarged with peeso-reamers between #1 and #6 protruding 1 mm beyond the apex to imitate immature apices. The specimens then were assigned randomly into three experimental groups according to the vehicles mixed with MTA Angelus (distilled water-DW, prophylene glycol-PG, chlorhexidine-CHX) and ten specimens left unfilled were used as control group ( $n=10$ ). To simulate a periodontal membrane, the apical 4 mm of roots were covered with approximately 0.2 - 0.3 mm thickness of wax before embedding the roots into acrylic resin cylinders. Specimens were subjected to fracture testing with an application tip at a crosshead speed of 1 mm/min under a universal testing machine (Instron Corp, Canton, MA) and maximum load which fracture occurred was recorded. The data were statistically analyzed with Kruskal-Wallis and Mann-Whitney Test.

**Results** The highest VRF resistance was revealed in PG group while the lowest was in control group. Statistically significant difference was found amongst VRF resistance of experimental groups with that of control group ( $P<0.05$ ) while no difference was found amongst the experimental groups ( $P>0.05$ )

**Conclusions** MTA increases the VRF resistance of immature permanent teeth. However, mixing MTA with CHX or PG as a vehicle do not alter the VRF resistance of the immature roots.

0421

# **Evaluation of Root-end Filling Materials in Cavities Prepared with Different Techniques**

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**Objectives** To evaluate the sealing efficacy and marginal adaptation of MTA, CEM and Biodentine in root-end cavities prepared by ultrasonic and laser tips.

**Methods** A total of 72 extracted human upper anterior teeth were used and randomly divided as 60 teeth in experimental groups and 6 teeth each for positive and negative control groups. The crowns were removed so that the length of all roots in experimental and positive control groups was adjusted to 15 mm and their root canals were instrumented. Only specimens in experimental groups were obturated and their root-end resections were performed. Specimens in experimental groups were randomly divided into six groups including 10 specimens in each group as follows: Grup 1: Ultrasonic retrotip+MTA, Grup 2: Ultrasonic retrotip+CEM, Grup 3: Ultrasonic retrotip+Biodentine, Grup 4: Er:YAG laser tip+MTA, Grup 5: Er:YAG laser tip+CEM, Grup 6: Er:YAG laser tip+Biodentine. Microleakage was measured by fluid-filtration method. Thereafter, 6 specimen from each experimental group were randomly selected to analyze marginal adaptation. Each specimen was prepared longitudinally in order to expose the filling materials. Then, the specimens were prepared for scanning electron microscopy analysis. Marginal adaptation was evaluated through scoring of taken micrographs and also measured with Image J software. Data were analyzed with; two-way ANOVA, Bonferroni, Kruskal-Wallis, Mann-Whitney-U, Siegel & Castellan and Spearman correlation coefficient tests.

**Results** According to the results, no significant difference was found between materials regarding microleakage and marginal adaptation ( $p>0.05$ ). Significantly higher microleakage and worse marginal adaptation were seen for materials placed in cavities prepared by laser tips compared with those prepared by ultrasonic tips ( $p<0.05$ ). Positive correlation was found between the results of scoring and Image J analysis ( $r=0.596$ ,  $p<0.001$ ).

**Conclusions** Different root-end cavity preparation techniques affected the microleakage and marginal adaptation of filling materials. CEM and Biodentine showed similar microleakage and marginal adaptation results to MTA.

Table 1. Marginal adaptation results based on scores and Image J analysis (mean±standard deviation)

Groups	Scores	Image J analysis
MTA (Ultrasonic)	2.5±0.54	1.62±0.89
CEM (Ultrasonic)	2.5±0.83	1.73±0.75

Biodentine (Ultrasonic)	2.33±0.81	1.41±0.63
MTA (Laser)	3.5±0.54	2.82±0.83
CEM (Laser)	3.66±0.51	2.76±0.73
Biodentine (Laser)	3.5±0.54	2.7±0.82

0422

#### **The relationship between serum YKL-40 acute phase protein and salivary cytokine levels in children with Sickie Cell Disease**

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**Objectives** Sickie cell disease (SCD) is a chronic inflammatory disease in which vaso-occlusive crisis and endothelial dysfunction are present. YKL-40, a new acute phase protein, is shown to be elevated in inflammatory diseases such as rheumatoid arthritis, type 2 diabetes mellitus, coronary artery diseases and periodontal diseases. The aim of this study was to investigate the relationship between salivary cytokine and serum YKL-40 levels in children with SCD.

**Methods** Forty-three children with SCD and 43 healthy children were included in the study. Physical, dental and periodontal statuses were examined, and blood and saliva samples were taken. Serum high sensitive C-reactive protein (Hs-CRP) and YKL-40 levels, and serum and saliva interleukin(IL)-6, IL-1 $\beta$  IL-8, tumor necrosis factor(TNF)- $\alpha$  total oxidant status(TOS), total antioxidant status(TAS), nitric oxide(NO) levels were evaluated. **Results** The periodontal findings of the groups were similar. The majority of the subjects in both groups had gingivitis. In SCD group, significantly higher serum YKL- 40, Hs-CRP, IL-6, IL-8, TNF- $\alpha$  TOS, NO and salivary IL-6, IL-8 and TNF- $\alpha$  levels were observed whereas serum and salivary total antioxidant status (TAS) levels significantly decreased in comparison with the controls ( $p < 0.05$ ). There were positive correlations between serum YKL- 40 and salivary IL-6 ( $r = 0.221$ ,  $p = 0.041$ ), IL-1 $\beta$  ( $r = 0.263$ ,  $p = 0.014$ ), TNF- $\alpha$  levels ( $r = 0.217$ ,  $p = 0.045$ ). Furthermore serum YKL-40 levels were highly correlated with serum Hs-CRP levels ( $r = 0.559$ ,  $p = 0.000$ ).

**Conclusions** Higher serum YKL-40 and cytokine levels observed in children with SCD in comparison with their healthy counterparts. Although, observed oral health status were similar in both groups, increased levels of local pro-inflammatory cytokines were determined in the patients with SCD. Furthermore serum YKL-40 levels correlated with salivary cytokine levels. YKL-40 might be a potential novel marker for inflammatory status in SCD. (This research was funded by TUBITAK, Grant number: 113S271)

0423

#### **Hematinic Deficiencies And Patient's Clinical Profile In Recurrent Aphthous Stomatitis (RAS)**

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**Objectives** Recurrent aphthous stomatitis (RAS) is a chronic, inflammatory, ulcerative disease of the oral mucosa without clearly defined etiopathogenesis, where the genetically mediated disturbances of the innate and acquired immunity play an important role. The objective of the study was to perform clinical evaluation of the oral mucosa in patients with RAS and to measure serum vitamin B12 and iron levels.

**Methods** The clinical condition of the oral mucosa was evaluated in 45 patients and in a control group of 44 subjects with RAS diagnosed and classified based on standardized criteria. Full blood count, the levels of serum vitamin B12 and iron were evaluated in all study participants. Statistical analysis was performed with Mann-Whitney, Kruskal-Wallis, chi-square and Fisher tests with significance level  $p < 0.05$ .

**Results** Minor aphthae (MiRAS), major aphthae (MaRAS) and herpetiform aphthae (HeRAS) were observed in 35 (78.8%), 7 (15.5%) and 3 (6.7%) subjects, respectively. On the basis of the frequency of the episodes, the course of RAS was evaluated as mild in 11 patients (24.4%), moderate in 27 patients (60.1%) and severe in 7 patients (15.5%). The mean serum iron level in the study group was  $88,3 \pm 35,7$   $\mu\text{g/dL}$ , which was significantly lower than in controls ( $103,4 \pm 34,3$   $\mu\text{g/dL}$ ). The mean vitamin B12 serum level was also lower in the study group than in the controls, the difference however was not statistically significant. The serum levels of iron and vitamin B12 were lower in patients with MaRAS than in those with MiRAS and HeRAS and in patients with a higher number of lesions during one episode.

**Conclusions** Mean serum levels of iron and vitamin B12 were found to be lower in RAS patients than in controls and in patients with MaRAS compared to other types of RAS, which suggests that hematinic deficiencies may modify the type and course of the disease.

0424

**Strong association between oral lesions and allergy**

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**Objectives** Several dental materials and oral hygiene products may be responsible for sensitization and allergic reactions in the oral mucosa. Persistent antigenic stimulation may lead to mucosal changes like generalised stomatitis, lichenoid lesions or oral lichen planus (OLP). The aim of this study was to determine the incidence of allergies in patients with OLP lesions without and with relation to dental materials, and to investigate whether clinical and histopathological characteristics allow differentiation between oral contact allergic reactions and lesions seen in OLP.

**Methods** Forty-eight patients (7 men and 41 women), aged 18 to 75 years (mean 59±11 years), with oral symptoms, generalized stomatitis and clinical signs of OLP without and without close proximity to dental restorations, were patch tested to the European baseline series (25 allergens), as well as to toothpaste and dental material series. The readings were taken on days 2, 4 and 7. The diagnosis of OLP was established in 38 patients, based on the symptomatology, clinical examination, and histopathological evaluation.

**Results** Eighteen patients had lesions in close contact with dental restorations, whereas 30 patients had more widespread lesions. Thirty-one patients, of whom 24 had OLP, have completed patch testing. Fifteen patients (48.3%) displayed positive reactions to tested allergens, primarily to perfume and aroma substances (e.g. spearmint, carvone L-, cinnamon), acrylates, nickel and colophony. Of these, 13 (86.6%) patients had more than one positive reaction. Positive reactions were observed in 11 (45.8%) patients with OLP. These patients did not differ with regard to symptoms, clinical and histopathological characteristics or relation to dental restorations or not.

**Conclusions** Our findings suggest that allergic sensitization is common in patients with OLP and that patch testing may be indicated in patients with OLP. Other allergies than allergies to dental materials may initiate, aggravate or perpetuate OLP.

0425

**The effects of nicotine and bilberry on rat gingival tissues: a histopathological study**

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**Objectives** Various studies have shown that nicotine is one of the local or systemic accelerants and exacerbators of periodontal disease. Bilberry is regarded as one of the most powerful antioxidants due to the 15 different anthocyanidins it contains. The purpose of this study was to determine the histopathological effects of nicotine and bilberry extract on rat gingival tissues.

**Methods** Twenty Sprague-Dawley rats with a mean weight of 300-320 grams were divided into four (4) groups. Group 1- (Control): Rats were given food and drink for 4 weeks, but no procedures were performed. Group 2 – (Nicotine): Rats received daily subcutaneous injection of nicotine at a dose of 2.5 mg/kg/day for 4 weeks. Group 3 – (Bilberry): Rats received bilberry at a dose of 100 mg/kg/day by gavage every day for 4 weeks. Group 4 – (Nicotine + Bilberry): Rats received daily subcutaneous injection of nicotine at a dose of 2.5 mg/kg/day followed by bilberry at 100 mg/kg/day by gavage. Hemorrhagic shock was subsequently induced through collection of intracardiac blood was subsequently collected under general anesthesia, and tissues were extracted. Tissues were fixed in 10% formalin. Then specimens were placed in a tissue processing (dehydration, clearing and infiltration) device. Sections 4 µm in thickness were then taken using a microtome and stained with hematoxylin and eosin. They were then examined under a light microscope (Olympus BX51). Histological findings were compared using non-parametric tests (chi square) ( $\alpha=0.05$ ).

**Results** The nuclear cytoplasmic ratio, nuclear hyperchromasia, pleomorphism and mitotic activity in gingival mucosa cells were evaluated. Histopathological changes were accordingly classified as hyperplastic, metaplastic or dysplastic. No significant difference was observed between the groups in terms of histopathological changes. ( $p>0.05$ )

**Conclusions** Long-term clinical studies and animal experiments are now needed in order to better elucidate the effects of bilberry extract and nicotine on gingival tissues.



0426

### **The Evaluation Of Styloid Process And Calcification Type On Both Genders With Different Age And Dental Status**

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**Objectives** The purpose of this study was to investigate the morphology and calcification pattern of the SP lengths in individuals its relation, if any, to subject age, gender and dental status.

**Methods** Nine hundred and ten panoramic radiographs were obtained and they were grouped into age, dental status and gender. SP length and morphologic calcification types were analyzed.

**Results** The right SP lengths had significantly greater values than another side ( $p>0,05$ ). The type D (right-42,9%, left 42%) and E (right-33,3%, left 30,8%) were the most common morphological calcifications on both sides. No statistical difference was found for bilateral SP length in gender, age and dental status groups ( $p>0,05$ ). A statistically differences was found for only right SP morphological calcification types as to age groups in both sexes ( $p<0,05$ ). No significantly difference was found for SP morphological calcification types according to gender and dental status ( $p>0,05$ ).

**Conclusions** The morphological types are formed to their present area. Even though the determination of the type of SP calcification base on the length of SP, the age isn't a effective factor on the length of SP but isn't associated with the morphological calcification type of SP according to the findings of present study. It can be concluded that another factors other than age can play role in developing of morphological calcification type of SP. According to these results, SP is autonomous structure from age, gender and dental status. The changes of SP lengths are accepted some abnormal situations' signs.

0427

### **A radiographic study: Are there any effects of systemic diseases on styloid process elongation?**

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**Objectives** The styloid process (SP) is a cylindrical, long cartilaginous bone located on the temporal bone. Several theories on the etiology of the styloid process elongation have been reported. The purpose of this study was to evaluate the relationship between the styloid process length (right-left) and some of the systemic diseases (Cardiovascular diseases, Diabetes Mellitus, Thyroid Diseases and different combination of those) and investigate the prevalence of elongated styloid process.

**Methods** The sample consisted of orthopantomographs (OPG) of 1000 subjects, aged 15-82 years (500 males and 500 females, within five age groups) who attended Selcuk University Faculty of Dentistry for an initial visit between 2012-2014 years. Orthopantomographs of the patients were obtained at 68 kVp, 10 mA, 13,9 sec. with digital OPG machines (Kodak® 8000, Rochester, New York, USA). The apparent length of the styloid process was measured by using Adobe® Photoshop® CS4 version 11.0 with a magnification factor of 1,27. The length of SP was measured in a similar way described by Okabe *et al* (2006). The observed results were analyzed using SPSS 21.0 (statistical package for social science Inc. Chicago, USA). Data were analyzed using descriptive statistics, chi-squared and Kruskal-Wallis test with a significant level at  $p<0,05$ .

**Results** A total of 1000 digital panoramic radiographs were enrolled in the present study. Elongated SPs were observed in 210 cases (21%). There was no correlation between right-left SP lengths, elongated SPs and some of systemic disorders ( $p>0,05$ ).

**Conclusions** The results suggest that there are no effect of systemic diseases on styloid process length. Another potential responsible factors on SP elongation (such as bruxism, unilateral mastication related to tooth loss, occlusal disarrangements) should be investigated.

0428

**Influence of a soft-drink on enamel, dentin and restorative materials**

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**Objectives** The aim of this study was to evaluate the effects of a soft-drink on microhardness of enamel, dentin and different restorative materials.

**Methods** One hundred and twelve restoration samples, twenty eight in each material (that is Ketac Molar-3M ESPE, Ketac Nano-3M ESPE, Silorane-3M ESPE and Z250-3M ESPE) were prepared. Fourty human extracted premolars were used to obtain enamel and dentin samples. After the baseline microhardness measurement, four experimental daily procedures were applied as follows. Group I; samples were immersed in acidic-soft drink (Coca-Cola) for five minutes during the five cycles. Group II; a remineralization agent (Tooth Mousse-GC) was applied as an additional procedure to that of Group I. Group III; cola was applied once a day for twenty five minutes. Group IV; the samples were kept in artificial saliva as control. Following the application procedure (1, 7 and 30 days), the microhardness were re-measured and the data were analyzed statistically.

**Results** The microhardness of Ketac Molar could not measured after cola exposure due to surface deterioration. The differences of Ketac Nano in all experimental procedures were significant ( $p<0.05$ ). On the contrary, Silorane was the unique material not affected by cola application. In enamel, differences between Group II and IV were significant ( $p<0.05$ ). Dentin microhardness were totally different from baseline with the exception of the control group ( $p<0.05$ ).

**Conclusions** In the limitation of this study it can be concluded that cola application influenced the microhardness of the dental hard tissues and restorative materials. Additionally, the highest deleterious effect of cola was determined for Ketac Molar and dentin samples.

0429

**The anti-erosive effect of children salivary pellicles on deciduous enamel.**

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**Objectives** In this cyclic study we assessed the protective effect of salivary pellicles on deciduous teeth against dental erosion.

**Methods** Stimulated saliva was collected from adults (20 – 30 year-olds) and children (7 – 13 year-olds). We prepared enamel specimens from 45 human deciduous canines, divided into three groups ( $n=15$ ): no pellicle control (NP), adults pellicle (AP) and children pellicle (CP). NP specimens received no saliva. Salivary pellicles were formed on the human deciduous enamel from AP and CP groups using the respective human saliva (2h in humid chamber at 37°C). The specimens were individually eroded (10 ml 1% citric acid; pH 3.6; 25°C; 1 min shaking 70 rpm) and then we measured enamel surface reflection intensity loss (SRI-loss) and microhardness loss (SMH-loss). Pellicle formation, erosion and surface measurements were repeated 4 times. Differences between groups were tested with nonparametric ANOVA, and post-hoc Wilcoxon Rank Sum tests.

**Results** We observed significantly more SMH-loss as erosion time increased ( $p<0.05$ ), due to enamel softening. After 4 min erosion, AP samples presented more softening (median SMH-loss of 78.0 KHN) than CP samples (median SMH-loss of 72.3 KHN;  $p=0.02$ ); and NP samples (median SMH-loss of 77.2 KHN) showed no significant differences to AP group ( $p=0.92$ ). Erosion also significantly decreased enamel reflectivity causing greater SRI-loss as erosion time increased ( $p<0.05$ ). After 4 min erosion, greatest SRI-loss was observed in the NP group, where median SRI values dropped from 100 % to 12 % ( $p<0.01$ ). AP samples presented more reflectivity loss than CP samples, where SRI values dropped from 100 % to 21 % in AP group, and from 100 % to 34 % in children pellicle group ( $p<0.01$ ).

**Conclusions** We observed that children pellicle provided significant protection for deciduous enamel erosion and children saliva plays an important role on erosion prevention in young children with deciduous dentition.

0430

### **Risk Factors for Dental Erosion in Yemeni Children and Adolescents**

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**Objectives** To investigate factors associated with severe dental erosion amongst Yemeni children and adolescents.

**Methods** Three random samples comprising a total of 911 were drawn from children and adolescents aged 5-6 (n=280), 13-14 (n=280) and 18-19 years (n=351) attending University of Science and Technology dental clinics in Sanaa for regular dental examination between September 2012 and June 2013. Dental erosion was graded using a partial recording index on anterior and posterior teeth (Johansson *et al.* 1996 and Hasselkvist *et al.* 2010). Out of all participants (n=668), 58 high erosion cases (grades 3 and 4) and 64 low erosion controls (grades 0 and 1) were selected. Dental caries was recorded by using the WHO criteria (1997) and dental fluorosis by the Thylstrup-Fejerskov index (1978). All participants were interviewed and answered a questionnaire about lifestyle, oral health and general health factors. Logistic regression analysis was performed.

**Results** Unadjusted logistic regression revealed statistically significant associations between severe dental erosion and older age, less plaque, gingival inflammation and dental fluorosis; frequent lime sucking, carbonated soft drink intake and fruit juice consumption; higher total amount of erosive beverages consumption, soft drink oral retaining drinking technique, presence of gastroesophageal reflux and no history of breast feeding. Adjusted logistic regression model showed less plaque (OR=8.2; CI=1.6-41.8), frequent lime sucking (OR=5.6; CI=1.1-28.7), and carbonated soft drink intake (OR=11; CI=1.9-63.4) as well as total amount of consumed erosive beverages (OR=20.9; CI=5.9-75.2) to be significant predictors for severe dental erosion. The sensitivity and specificity of the model were 87.5% and 89.3%, respectively, while Nagelkerke's R<sup>2</sup> coefficient was 0.67.

**Conclusions** Severe dental erosion was associated with higher consumption of acidic beverages and frequent lime sucking while presence of plaque was associated with lesser severity of dental erosion.

0431

### **In Vitro Assessment of Incisal Tooth Wear by Various Methods**

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**Objectives** Tooth wear is recognized as an increasing clinical problem as life expectancy increase and teeth are retained for longer. It is considered as pathologic when the loss of dental tissue exceeds what is perceived to be normal. Any kind of pathologic tooth wear can cause several harmful effects on dental hard tissues, periodontal tissues and masticatory system. Although it is difficult to diagnose at early stages, treatment of an early diagnosed potential tooth wear is easier and cheaper than an advanced one.

**Aim** of this study was the assessment of various methods used on diagnosis of dimensional changes of worn human incisors at different time periods.

**Methods** 100 extracted human incisors were divided into two groups as "enamel" and "enamel-dentin". Incisal edges of the teeth were abraded gradually for four times in a specially modified mechanical two-body surface grinder. Before and after each grinding, dimensional changes of the teeth were evaluated by ultrasonic system, digital radiography, digital photography and digital modeling. Ultrasonic system was used only for the enamel group. Digital micrometer was used as control method. Student t Test, Mann Whitney U Test and Intraclass Correlation Coefficient tests were used for statistical analysis.

**Results** Control method and ultrasonic system could diagnose worn enamel accurately and reproducibly at different time periods at 50µm depth, however digital radiography, digital photography and digital modeling methods could only diagnose dimensional differences more than 100 µm for both groups (p<0.01).

There was no statistically significant difference between two groups according to the difference values between the abrasions for control and test methods (p<0.05, p<0.01).

**Conclusions** As a non-destructive, sensitive and accurate method ultrasonic system seemed to be a promising diagnostic tool for measuring tooth wear at early stages and tracking the dimensional changes.

### Chitosan based systems as dentin hypersensitivity agents

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**Objectives** Sodium fluoride (NaF) is being widely used as a hypersensitivity agent, however the precipitates formed by fluoride can be mechanically removed by the action of saliva or mechanical action. Chitosan is a biopolymer which exerts bioadhesive and permeation enhancing properties. In this study, chitosan was used to develop a delivery system for hypersensitivity agents, which will provide long term effects whilst avoiding negatively affecting environmental factors.

**Methods** 45 Human molar dentin specimens were obtained, ground and polished. Chitosan gels at 2% concentration were prepared in diluted lactic acid and 5 % NaF was incorporated into the gels (DH group-1, n=15). A commercially available product (Clinpro® 5% NaF White Varnish with tri-calcium phosphate, 3M ESPE) was used for comparison (DH group-2). 1% citric acid was applied for 5 min to all specimens including the control group. Formulations were applied for 24 h. Five daily demineralisation–remineralization cycles of 5 min of immersion in a citric acid (0.3 %) and in artificial saliva were conducted during 7 days. All specimens were stored in artificial saliva between and after cycles. After 7 days, the dentin surfaces were analysed by SEM and confocal laser scanning microscopy.

**Results** The tubule diameters in the both DH groups were found to be significantly smaller than the control group ( $P < 0.05$ ). A higher decrease in number of exposed tubules was observed with chitosan based systems.

**Conclusions** 5% NaF-chitosan provides a significantly enhanced effect on dentine surface by and avoiding sodium fluoride removal and decreasing the tubule diameters. A chitosan-based sodium fluoride system can be suggested promising for the treatment of dentin hypersensitivity (DH).

### 0434

#### Does cytotoxicity of different implants vary on fibroblasts and osteoblasts?

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**Objectives** The aim of this study was to compare the cytotoxic effects of three implant materials on primary gingival fibroblast and osteoblast precursor cells (MC3T3).

**Methods** Three implants of Implant Direct (titanium-based) (Sybron International, USA), Implant (titanium-based) (AGS Medikal, Turkey) and SisoMM (Peek-based implant system, Belgium) were used and immersed in the culture medium for 1, 5 and 7 days according to the ISO 10993-12 standards. A real-time cell analyzer (xCELLigence, Roche Applied Science) was used to evaluate cell survival. Following the seeding of the wells of the E-plate with fibroblast and osteoblast cells, they were treated with 1<sup>st</sup>, 5<sup>th</sup> and 7<sup>th</sup> day extracts of the test materials and cell indexes were monitored every 15 minutes for 96 hours. One-way ANOVA and Bonferroni's multiple comparison tests were used for statistical analyses in order to assess the cell viability with respect to implant materials and experiment duration ( $\alpha=0.05$ ).

**Results** On fibroblast cells, the viability percentage ratios for the Implant Direct, Implant and SisoMM-peek based implant materials were 67.67, 60.00, 93.33 for the 1<sup>st</sup> day; 60.00, 58.00, 92.14 for the 5<sup>th</sup> day; and 67.5, 55.00, 86.18 for the 7<sup>th</sup> day, respectively. These ratios on osteoblast cells for Implant Direct, Implant and SisoMM peek-based implant materials were 28.65, 23.29, 26.49 for the 1<sup>st</sup> day; 52.77, 21.01, 39.69 for the 5<sup>th</sup> day and 100.60, 23.63, 38.59 for the 7<sup>th</sup> day, respectively.

**Conclusions** Cytotoxic effect of implant materials was moderate on fibroblast cells, anyhow they displayed more severe effects on osteoblasts. SisoMM-peekbased implant showed the least cytotoxic effect on the fibroblast cells, whereas Implant Direct was the most biocompatible material on osteoblast cells.

0435

**Nanocoating with Rhamnogalacturonan-I pectins prevent from *Porphyromonas gingivalis* infection**

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**Objectives** Plant-derived Rhamnogalacturonan-I (RG-I) from pectins is a potential candidate for surface nanocoating of medical devices due to its chemical and physical properties.

In this study RG-I's anti-inflammatory properties were investigated, which may decrease a risk of infection in immunocompromised patients with chronic inflammatory disorders such as rheumatoid arthritis (RA) and periodontal disease (PD).

The aim was to evaluate anti-inflammatory effect of RG-I nanocoating in *Porphyromonas gingivalis* (*P.gingivalis*) infected mice osteoblast cell culture.

**Methods** RG-I from potato (P) pulps were isolated, modify enzymatically, providing two different structure of RG-I: potato unmodified (PU), potato dearabinanated (PA).

The *in vitro* assays, proliferation, cell viability, mineralization, gene expression, toxicology, flow cytometry were examined in four time points and repeated six times each (n = 6). The osteogenic response was examined using mice osteoblast-like cells MC3T3 and primary osteoblast isolated from calvariae of wild type (WT) C57BL/6 mice. All *in vitro* experiments were performed with bacteria infection to examine the RG-I anti-inflammatory effect with *P.gingivalis* infection compared to control.

**Results** The results showed that after *P.gingivalis* infection, cell proliferation and flow cytometry after 12, 24, 48 and 72 h, when cultured on PU and PA was significantly higher compared with cells cultured on control surface without pectin nanocoating. The cell viability observed after 3, 7, 14 and 21 days from *P. gingivalis* infection was enhanced on surface coated with PA and PU compared to control. Mineralization of *P.gingivalis* infected cells observed after 3, 7, 14 and 21 days showed that osteoblasts on surface with PA formed higher amount of mineralized matrix than the cells on control surface. In presence of *P.gingivalis* IL-1, IL-6 and TNF-alpha were down-regulated in cell cultured on PU and PA.

**Conclusions** Pectin RG-Is nanocoating with high content of galactan (PA) prevents from *P.gingivalis* infection *in vitro* and may therefore reduce a risk of inflammation.

0436

**SinusJet Direct intralift : A new minimally invasive transcrestal sinus floor elevation procedure: Technique and preliminary results**

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**Objectives** SinusJet is a new surgical tool developed to achieve minimally invasive hydraulic transcrestal sinus floor elevation (TSFE) without the use of an osteotome or a mallet. The aims of this study is to describe the surgical procedure called "controlled hydraulic pressurized direct intralift" (CHPDIL), and evaluate the clinical results.

**Methods** 50 patients received 68 CHPDIL with simultaneous placement of 110 implants and a mean follow-up of 2 years. SinusJet drill creates the primary access channel to sinus. Thanks to its original inner irrigation system, physiological liquid flows through maxillary bone during drilling, unsticks and elevates sinus membrane before the drill penetrates into the sinus cavity. The drill backflowing security system ensures a safe intrabony working pressure. Valsalva's maneuver controls sinus membrane integrity. The medical grade nanocrystalline hydroxyapatite paste used as augmentation material also contributes to membrane unsticking and elevation from sinus floor. Five parameters were mainly followed: grafting material loss, implant survival rate, per-operative complications (sinus membrane perforation), post-operative complications, level of intraoperative and postoperative patient comfort using a visual analogue scale.

**Results** The mean height of the residual alveolar process was 4,5 +/- 1,6 mm. A mean sinus floor elevation (SFE) of 8,4 mm +/- 4,2 mm was performed. The mean bone height after SFE was 12,9 +/- 3,7 mm allowing the immediate placement of 110 implants with a mean length of 10,7 +/- 1,0 mm. There was only 1 Schneiderian membrane perforation and no graft lost. One implant was lost (survival rate of 99,1 %). No surgical complications nor post-operative complications were reported. Only one patient experienced discomfort during the procedure and post-operative period.

**Conclusions** Within the limits of this preliminary study, CHPDIL seems a predictable method for TSFE and immediate implant placement. This minimally invasive procedure minimizes patient discomfort as it avoids the use of an osteotome or a mallet during TSFE procedure. It simplifies the techniques regarding all existing alternative TSFE techniques as it avoids the use of multiple instruments or drills. Observations on a larger number of patient and on a longer observation period is needed.

0438

**Osteoinductive potential of Vivoss, a novel biphasic calcium phosphate bone graft in comparison to autographs, xenografts and DFDBA**

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**Objectives** Since the original description of osteoinduction in the early 20th century, the study and development of innovative biomaterials has emerged. Recently novel synthetic bone grafts have been reported with potential to form ectopic bone *in vivo*. However, their full characterization in comparison to other leading bone grafts has not been investigated. The aim of the present study was to determine the osteoinductive potential of bone grafts by comparing autogenous bone grafts, demineralized freeze-dried bone allografts (DFDBA), a commonly utilised natural bone mineral (NBM) from bovine origin (Bio-Oss) and a newly developed biphasic calcium phosphate (BCP, Vivoss).

**Methods** Grafts were compared *in vitro* for their ability to stimulate bone marrow stromal cell (BMSC) migration, proliferation and differentiation as assessed by quantitative real-time PCR for genes coding for bone-markers including Runx2, collagen I and osteocalcin. Furthermore, bone grafts were implanted in the calf muscle of beagle dogs to determine their potential to form ectopic bone *in vivo*.

**Results** The *in vitro* results demonstrate that both autografts and DFDBA show potential for cell recruitment whereas only autografts and BCP demonstrated ability to differentiate BMSCs towards the osteoblast lineage. The *in vivo* ectopic bone model demonstrated that while NBM particles were not osteoinductive and autogenous bone grafts were resorbed quickly *in vivo*, ectopic bone formation was reported in DFDBA and in synthetic BCP grafts.

**Conclusions** The modifications in nanotopography and chemical composition of the newly developed BCP bone grafts significantly promoted ectopic bone formation confirming their osteoinductive potential. In conclusion, the results from the present study provide evidence that synthetic bone grafts not only serve as a 3 dimensional scaffold but are also able to promote osteoinduction.

0439

**Bioactivity of a calcium silicate-based endodontic cement (BioRoot RCS): interactions with human periodontal ligament cells *in vitro***

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**Objectives** Tricalcium silicate-based materials are recognized as bioactive materials through their capacity to induce hard tissue formation both in the dental pulp and bone. Sealing the apex implies that the root canal filling materials interact with the periapical tissues. This work was designed to study the interactions of newly developed tricalcium silicate cement (BioRoot RCS) with the apical tissue as compared to a standard zinc oxide eugenol sealer (Pulp Canal Sealer).

**Methods** Cell viability was assessed by a direct contact between human periodontal ligament (PDL) cells and BioRoot RCS or Pulp Canal Sealer (PCS). In addition, an *in vitro* tooth model was used to study the interactions between these materials and periodontal ligament cells. For this purpose, human extracted incisors were sectioned at the enamel–cementum junction; root canals were prepared, sterilized and filled with lateral condensation with both materials. The root apices were dipped in the culture medium for 24 hours. These conditioned media were used to investigate their effects on human PDL cells. Cell proliferation was investigated with the MTT assay and secretion of angiogenic and osteogenic growth factors was quantified using ELISA.

**Results** BioRoot RCS has less toxic effects on PDL cells than PCS and induced a higher secretion of angiogenic and osteogenic growth factors than PCS.

**Conclusions** Taken together, these preclinical results suggest that the calcium silicate cement (BioRoot RCS) has higher bioactive properties than the zinc oxide eugenol sealer (PCS) on human periodontal ligament cells. Based on these results it could be hypothesized that BioRoot may have the potential to induce angiogenesis and osteogenesis. Both properties are pre-requisites for periapical tissues regeneration.

0440

**LEAKAGE EVALUATION OF IMMATURE TEETH FILLED WITH BIOMATERIALS: MTA, BIODENTINE AND TECHBIOSEALER APEX**

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**Objectives** Objectives of this in-vitro study was to evaluate the sealing ability of ProRoot MTA, Biodentine and TechBiosealer apex.

**Methods** Fourty-six maxillary anterior teeth were used in this study. Five teeth were selected as a negative control. Access cavities of the remaining teeth were prepared and the apical parts of the roots were sectioned 9 mm below the cemento-enamel junction. All roots were instrumented with rotary nickel-titanium files. The root canals were irrigated with 2 ml of a freshly prepared solution of 2.5 % NaOCl between each instrument. To simulate the immature teeth Peeso reamers were introduced until no:6 peeso reamer could be passed 1 mm beyond the apex. Smear layer was removed with 5 ml of 17 % EDTA, 5.25 % NaOCl and distilled water. After drying root canals, calcium hydroxide paste was introduced into the root canals and the coronal access cavity was filled with temporary filling material.

After 7 days, calcium hydroxide paste was removed. The root canals were dried with paper-points and the specimens were divided into three experimental groups and positive control group.

Group 1 (Biosealer, 12): Root canals were filled with TechBiosealer apex

Group 2 (Biodentine, 12): Root canals were filled with Biodentine

Group 3 (ProRoot MTA, 12): Root canals were filled with ProRoot

After setting of the root canal fillings coronal access cavities were filled with composite resin. Micro-leakage was measured using the fluid filtration method after 1 week. Measurements were recorded at 2-minute intervals for 8 minutes. The results were calculated as Lp and evaluated statistically using Kruskal-Wallis and Hollander-Wolfe tests ( $P < 0.01$ ).

**Results** TechBiosealer apex showed more leakage than ProRoot MTA and Biodentine. There was no significant difference in fluid leakage between ProRoot MTA and Biodentine.

**Conclusions** Under the conditions of this in-vitro study ProRoot MTA and Biodentine showed better sealing ability than TechBiosealer apex.

0441

**Reparative dentin formation after pulp capping with a curable Hydrogel compared with a calcium hydroxide liner, Dycal®**

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**Objectives** The formation of reparative and reactionary dentin was compared after pulp capping either with Hydrogel or a calcium hydroxide liner, Dycal®, for 1 to 4 weeks.

**Methods** Occlusal cavities were drilled in the 1<sup>st</sup> maxillary molar of rats and pulp exposures done in the deepest part of the dentin cavity. Direct capping was carried out with a two-component self-cured gel (Hydrogel) composed of Bovine Serum Albumin and glutaraldehyde (group 1: G1), compared with a self-cured Dycal (group 2: G2). G1 were the right molars of twenty 6 week-old rats, whereas G2 involved left molar of the same animals. After 1, 2, 3, and 4 weeks, the rats were anaesthetized intraperitoneally, intracardially perfused with buffered 4% paraformaldehyde fixative. Molar's blocks were demineralized with a 4.13% EDTA solution under microwave, dehydrated and paraffin embedded. Rehydrated sections were stained with Masson trichrome or immunostained. **Results** One week in G2, inflammatory cells formed aggregates, with mild pulpal necrosis. At 2-3 weeks, a dentinal bridge started to be formed at the junction between the necrotic and vital tissue. At 4 weeks, reactionary dentin was formed at the periphery of the pulp chamber, beneath a calcio-traumatic line. In G1, 1 week after Hydrogel capping, the inflammatory process was less visible, and apparently solved afterwards. Reactionary dentin displayed an increased thickness compared with G2, with a thick layer of osteodentin-like tissue. Hydrogel also contributed to the massive formation of a reparative dentinal bridge, with tunnels disturbances. Immunostaining for type 1 collagen, dentin matrix protein-1, bone sialoprotein and dentin sialoprotein was systematically weaker after Hydrogel implantation compared to Dycal.

**Conclusions** Dycal appeared to involve an initial inflammatory process, whereas the Hydrogel pathway was controlled primarily by non-inflammatory events. Unpredictably, a reverse relationship was detected by immunostaining between extracellular matrix molecules and pulp reparative mineralization.

0442

***In vitro* evaluation of the bioactivity of Hydrogel, a new pulp-capping agent via pulpal stem cells**

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**Objectives** The aim of this study was to evaluate the biocompatibility and osteoinductive properties of a two-component self-cured gel composed of bovine serum albumin and glutaraldehyde (Hydrogel) using the mouse pulp-derived stem cell line A4, which have an osteo/odontogenic potential *in vitro* and contribute to efficient bone repair *in vivo*.

**Methods** A4 cells were cultured at the stem cell stage in the presence of Hydrogel discs for cell viability evaluations by the MTT assay on days 1, 3, 7 and 10. A4 cells without discs were used as control for MTT test. A4 cells were induced towards osteo/odontogenic differentiation to assess the impact of the Hydrogel on mineralization by Von Kossa and Alizarin red staining and to measure the expression of odontoblast markers (type 1 collagen, DMP1, DSP or BSP) by immunolabeling on days 7 and 14. Steady state A4 cells exposed to hydrogel discs was used as negative control.

**Results** Exposure to Hydrogel did not alter the viability and morphology of A4 pulpal cells at the end of 10 days. Hydrogel preserved the intrinsic ability of A4 cells to express type 1 collagen, DMP1, DSP or BSP at the stem cell stage.

**Conclusions** Hydrogel exhibited no cytotoxicity after 10 days. It did not recruit the pulpal stem cells towards differentiation but preserve their osteo-odontogenic intrinsic properties.

0443

**Evaluation of fast-setting calcium silicate (Protooth): fluoride-release, compressive strength, radiopacity**

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**Objectives** Novel dental cement (Protooth) with fluoride and fast-setting has been developed for practical treatments in the crown. Earlier studies revealed significant apatite around the material in physiological fluid (PBS). The aim of this study was to evaluate initial setting time, fluoride release, radiopacity and compressive strength of Protooth in comparison to frequently used cements.

**Methods** The Protooth is nanohybrid calcium silicate powder including calcia, silica, soluble fluoride, alumina, sulphate, phosphate, and zirconia as radiocontrast. The liquid contains long-chained weak 2% polycarboxylic acid (Protooth™ pat., Dentosolve Aps). Liquid and powder was capmixed to paste at flowable or condensable consistency. Initial setting time was measured in Gillmore test. The released fluoride in water was determined by electrode (Orion Research, Beverly, Mass., USA). Radiopacity was measured by using a photographic densitometer (Denso-dent, Pehamed, Germany) to measure density of radiographic images of samples. Compression samples were stored at 37C in 100% humidity for 24h. The strength was tested in universal testing machine (Instron). Dental materials including Dycal® (Caulk), IRM® (Caulk), Zn-phosphate (DeTrey), Biodentine (Septodont), and Proroot® MTA (Maillefer) were mixed according to the manufacturers instructions.

**Results** Protooth has initial setting time in the practical range of 2-10 min. Presence of soluble fluorides is associated with increased fluoride release. The compressive strength of Protooth was significantly higher in comparison to all tested dental cement materials including Zn-phosphate cement, IRM, Biodentine, and Proroot MTA. The use of dental materials with long setting-time in the tooth crown may be a disadvantage due to risks of material dissolution and displacement.

**Conclusions** In this study we observed that the novel calcium silicate has radiopacity, fluoride release, improved compressive strength, and fast setting, allowing for new applications in the crown. Further studies on use of Protooth for cementation and caries prevention seem relevant.



0444

#### **Apatite precipitation in gaps between Protooth™ and dentin**

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**Objectives** Gap at the restoration-tooth interface can increase the risk of secondary caries. Although, the optimal use of permanent restorative materials minimizes gap formation, none of the routinely-used restorative materials, like resinous composites, are able to eliminate gaps completely. Novel calcium silicate cement (Protooth™) with calcium hydroxide and fluoride release has been developed with fast-setting at flowable or clay-like consistency. The material is thereby candidate for new applications including: lining, temporary filling, and cementation in the crown. Our previous study demonstrated the formation of apatite layer over Protooth in physiological-like solution (PBS). The aim of this study was to evaluate the ability of Protooth to close the gap entrance between dentin and material by apatite precipitation.

**Methods** Calcium silicate-based cement containing 10% radiocontrast (Protooth) and resin-modified glass ionomers (Vitrebond™ and GC Fuji II LC) were tested in this study. Experimental gaps with 300±20 and 50±10µm width and 1 mm length were made between the restorative material and dentin ( $n = 6$ ). Changes of the entrance area in 300µm gaps immersed in PBS were measured by 2D-nucleator using NEW-CAST software. Micro-tomography (µCT) and SEM/EDX were used to analyze gap precipitation in both gap sizes.

**Results** In all Protooth samples precipitation closed the gap entrance area after 96h immersion in PBS. No precipitations were observed in Vitrebond and GC Fuji II LC gap entrance area. Micro-CT scans confirmed the complete closure of gap entrance area in Protooth samples with 50 and 300µm gaps. Voluminous gap precipitation was observed in Protooth samples after 6 months. SEM/EDX analysis revealed the formation of apatite precipitations that closed the entire gap entrance.

**Conclusions** Interestingly, gap entrance between Protooth and dentin can be filled with continued apatite deposition. Accordingly, further clinical studies regarding the effect of Protooth on gap closure, microleakage, and secondary caries, seems relevant.

0445

#### **Ability of restorative materials to buffer acids from bacterial origin**

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**Objectives** Composites seem to be more susceptible to secondary caries (SC) compared to other restorative materials. One of the reasons for this could be their inability to buffer acids produced by cariogenic bacteria. However, this material property has not been investigated before. The aim of our study was to test the ability of different restorative materials and hydroxyapatite (HA) to neutralize lactic acid and to increase the pH.

**Methods** Disks of composite (Z100, 3M ESPE, Germany), amalgam (Cavex, Netherlands), glass-ionomer (GIC, Ketac Fil, 3M ESPE) and giomer (Beautifil II, Shofu, Japan) were prepared; same size HA disks were obtained from Himed (USA). Solutions of lactic acid in distilled water with a final pH of 4, 5.5 and 7 were prepared. In addition, *Streptococcus mutans* cultures were grown in Brain Heart Infusion broth diluted with physiological saline (1:10) at 37°C. After 24h, the bacterial suspension was centrifuged and the supernatant containing bacteria-produced acid (pH=5.02) was collected. Material specimens were exposed to 500 µl of the prepared solutions and supernatant in 48 well-plates ( $n=3$ ), and the pH of the solutions was measured daily for 3 days. Solutions without specimens served as control.

**Results** Already after 24h, all materials except for composite increased the pH of solutions from 4 and 5.5 up to 6.3 (GIC and giomer) or 7.5 (HA and amalgam); the pH in the composite group remained the same as that of the control during all 3 days. A similar effect was observed with the supernatants which contained *S. mutans*-produced acid: while amalgam increased the pH from 5 to 5.9 (24h) and to 6.3 (72h), the pH in composite group remained unchanged after 72h.

**Conclusions** Composite, unlike other restorative materials, lacks the ability to buffer low pH caused by bacteria-produced acids, which may be one of the reasons for its higher susceptibility to SC.

0447

#### **Bond Strength of a Universal-Adhesive to Bleached & Desensitized Enamel**

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**Objectives** To evaluate the effect of different desensitizing agents on the bond strength of a universal adhesive system to the bleached enamel.

**Methods** Fifty enamel surfaces were obtained from the buccal surfaces of extracted human non-carious mandibular incisors. The specimens were embedded in acrylic resin and the surfaces were ground flat with 600, 1000, 2500 and 4000 grits of SiC papers. Teeth were randomly divided in five experimental groups (n=10):

- (1) No bleaching agent and desensitizer were applied (control group),
- (2) Office-Bleaching (Total Blanc Office Dental Whitening 35% Hydrogen-Peroxide/DFL),
- (3) Office-Bleaching + Desensitizing Agent (DA) (Potassium nitrate&Fluoride/UltraEZ, Ultradent),
- (4) Office-Bleaching + DA (Hydroxyapatite & Potassium nitrate/ExSense, Cavex),
- (5) Office-Bleaching + DA (Hydroxyapatite/Teethmate Desensitizer, Kuraray).

Composite cylinders (Clearfil Majesty ES-2 Premium A1, Kuraray) were bonded using a jig with universal adhesive (Clearfil Universal Bond, Kuraray) regard to total-etch procedure after 14 days. After storing specimens in distilled water 24 hours, the shear bond strengths (SBS) (MPa) were examined using a universal testing device at a crosshead speed of 1 mm/min. Failure mode distribution was also evaluated. Kruskal-Wallis and Conover Dunn tests, with a significance level of  $p=0.05$ , were used for data analysis.

**Results** The highest mean shear bond strength value was observed in Group 4 ( $13.70 \pm 5.08$ ) where as the lowest bond strength value was observed in Group 5 ( $7.80 \pm 3.88$ ). A significant difference was seen only between group 4 and 5 ( $p=0.049$ ). The failure modes were mainly adhesive for all of the groups (100% for Group 1, 4, 5, 90% for Group 2, and 80% for Group 3) The failure mode distributions among the groups were similar ( $p>0.05$ ).

**Conclusions** Application of desensitizers after office bleaching could hamper the bond strength of universal adhesive to enamel.

0448

#### **Influence of antioxidant treatment on bond strength to enamel after tooth bleaching**

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**Objectives** The objective of study was evaluate the effect of 10% sodium ascorbate (SA), 10%  $\alpha$ -tocopherol (TP), 6.5% grape seed extract (GS) on shear bond strength of adhesive resin cement to bleached enamel in different application times.

**Methods** 108 human maxillary central teeth were randomly divided into 9 groups (n=12). Except control group the labial surface of all specimens in the other groups were bleached with 40% hydrogen peroxide (HP). The groups are; GC: Restored on unbleached enamel; GB: Restored immediately after bleaching; GS7d: Restored after stored in artificial saliva for 7 days; GSA15: Treated with 10% SA for 15 min; GSA60: Treated with 10% SA for 60 min; GTP15: Treated with 10% TP for 15 min; GTP60: Treated with 10% TP for 60; GGS15: Treated with 6.5% GS for 15 min; GGS60: Treated with 6.5% GS for 60 min. After conditioning with antioxidant agents indirect restorations were immediately bonded with adhesive resin cement and stored in distilled water for 24 h at 37°C before shear bond strength testing. Failure mode were determined with stereomicroscope. The data were analyzed using one-way analysis of variance, Levene and Tukey HSD tests ( $\alpha<0.05$ ).

**Results** There was a significant reduction in bond strength of restored teeth immediately after bleaching ( $p<0.05$ ). GS7d and GTP60 showed comparable shear bond strength values compared with the GC ( $p>0.05$ ). The shear bond strength of all antioxidant groups were similar to each other ( $p>0.05$ ), and except for the GTP60, all of the antioxidant groups showed comparable values with the GB ( $p>0.05$ ). Fracture modes were predominantly of an adhesive type.

**Conclusions** All the antioxidants used in the study increased the shear bond strength of bleached enamel. Among the antioxidant groups treatment with  $\alpha$ -tocopherol for 60 min or a delay of 7 days may be best choices after bleaching to ensure successful bonding to enamel.

0449

# **The evaluation of resin infiltration effects on bleached initial caries**

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**Objectives** The aim of this *in vitro* study was to investigate the effect of resin infiltration on color and microhardness of white spot lesions treated with bleaching and to analysis of the penetration of the infiltrant. **Methods** Enamel specimens were prepared from extracted bovine incisors (n=135). Initial color and surface hardness were measured with spectrophotometer using the CIE L\*a\*b\* system and a Vickers hardness device, respectively. After producing artificial white spot lesions, color and hardness values were re-measured. Then specimens were randomly divided into three groups (n=45): Group I-resin infiltrated (ICON); Group II- bleached (Opelescence Boost, 40% Hydrogen Peroxide); Group III-bleached/resin infiltrated. After subjecting all specimens to pH cyclus for 4 weeks, assessment of color and microhardness were repeated. Color alterations ( $\Delta E^*$ ) and the percentage of surface microhardness recovery (SMHR) were calculated. The penetration of infiltrant was evaluated with scanning electron microscope. Data were submitted to one-way ANOVA and Tukey test (5%) **Results** There were no statistically significant differences in  $\Delta E^*$  values between group I and II (p=0.525). Highest color alterations were observed in Group III that was significantly different from Group I and III (p=1.00). Bleached samples (Group II) showed the lowest SMH recovery (p<0.005). The penetration of resin infiltrant was significantly deeper in Group I.

**Conclusions** Application of resin infiltration after bleaching of white spot lesions could influence color alteration positively. Moreover, the microhardness of white spot lesions either bleached or not was increased with resin infiltration. The bleaching treatment influenced the penetration of the infiltrants negatively.

0450

# **Evaluation of Ozone, Carbamide-peroxide and Hydrogen-peroxide on Bleaching Efficacy**

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**Objectives** The purpose of this *in vitro* study is to investigate the bleaching efficacy of ozone generator Ozonytron XP/OZ, and to compare its effect with two office bleaching systems, containing carbamide peroxide or hydrogen peroxide.

**Methods** Samples obtained from labial surfaces of 60 bovine maxillary incisors were placed on labial surfaces of epoxy resin teeth compatible with jaw simulator (Kavo Jaw Simulator, KavoDental GmbH, Germany). After finishing and polishing procedures, baseline colors of samples were measured by spectrophotometer (Vita EasyShade Compact, VITA Zahnfabrik, Germany). Samples were divided into two groups (n:30), and each group was immersed in coffee or tea solution for 90 hours at 37°C in a dark incubator. Each group was divided into three subgroups (n:10). Whitening trays were prepared and the samples were bleached on jaw simulator as follows; hydrogen peroxide (Whiteness HP Blue, FGM, Brazil), carbamide peroxide (Opalescence Quick PF 45%, Ultradent Products, USA) or ozone generator (OzonytronXP/OZ, Ozonytron GmbH, Germany). Color measurements were repeated after staining and bleaching. Color change was analysed thusly, baseline-after staining ( $\Delta E1$ ), after staining-after bleaching ( $\Delta E2$ ) and baseline- after bleaching ( $\Delta E3$ ). The data were analysed by using Mann Whitney U and Kruskal Wallis tests and Conover's multiple comparison tests for non-parametric data.

**Results** It has been observed that tea had more staining effect than coffee (p<0,0056), both of three bleaching methods bleached the stained samples efficiently but the hydrogen peroxide and carbamide peroxide had more powerful bleaching effect than ozone (p<0,0083). Bleaching methods failed to match the baseline colors, even though they provided effective bleaching.

**Conclusions** Ozone, that is known to have fewer side effects than hydrogen peroxide and carbamide peroxide, can be used effectively as a new option for bleaching treatment.

Mean  $\Delta E$  values according to staining types

	$\Delta E1$	$\Delta E2$	$\Delta E3$
tea	10,7 (3,35)	7,1 (2,33)	5,7 (2,41)
coffee	11,6 (3,27)	10,8 (5,13)	6,3 (3,94)
p value	0,005*	<0,001*	0,684

**Mann Whitney U test with Bonferroni correction; p<0,017**

**Mean  $\Delta E$  values according to bleaching methods**

	$\Delta E1$	$\Delta E2$	$\Delta E3$
Ozone	10,7 (4,30)	6,7 (2,49)a,b	5,2 (2,51)
Carbamide Peroxide	11,7 (2,11)	10,2 (5,32)a	6,6 (1,72)
Hydrogen Peroxide	10,6 (2,25)	9,5 (5,89)b	5,4 (4,09)
p value	0,185	<0,001	0,021

Kruskal Wallis test with Bonferroni correction, p<0,017 a: Difference between ozone group and carbamide peroxide group, (p<0,001) b: Difference between ozone group and hydrogen peroxide group, (p<0,001)

**0451**

**Effect of Different Laser Irradiations on the Enamel Surfaces of Teeth Treated with Hydrogen Peroxide**

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**Objectives** Objectives: Recently bleaching agents have gained more importance, because of the increased esthetical demands of many patients. In order to obtain better results with the available bleaching agents, lasers gained popularity with combination of applications. The aim of this study was to investigate whitening efficacy of two whitening agents in combination with two different photoactivation systems. Also, the changes in the micromorphology of the enamel surface after bleaching were evaluated.

**Methods** Methods: Seventy two extracted human incisors were divided into two groups; Opalescence and Whiteness bleaching agents, containing 35% hydrogen peroxide. Then the samples of two groups were divided into six subgroups as follow: Group 1: Whiteness stimulated with erbium-doped yttrium aluminum garnet (Er:YAG) laser (WE), Group 2: Whiteness stimulated with low-power diode laser (WD), Group 3: Whiteness no light source stimulation was applied (WC), Group 4: Opalescence stimulated with Er:YAG laser (OE) Group 5: Opalescence stimulated with low-power diode laser (OP) Group 6: Opalescence no light source stimulation was applied (OC). After treatments, color change and enamel morphological alterations were evaluated. The statistical evaluations were done using two-way and one-way ANOVA tests in SPSS software.

**Results** Results: There was statistically significant differences between bleaching agents and laser groups (p<0.05). There was statistically significant color change in all of the groups except WC group ( $\Delta E < 3.3$ ). Er:YAG laser stimulated Opalacence bleaching group gave a significantly higher  $\Delta E$  (7.53) after treatment (p<0.05). Scanning electron microscopy showed no evidence of effects on the integrity of enamel.

**Conclusions** Conclusions: The source of irradiation is more relevant than the bleaching agent for efficient tooth whitening. In addition, photoactivation with Er:YAG laser is effective at providing brighter teeth when assisted with Opalescence.

0454

**The evaluation of intrapulpal temperature rise during the treatment of cervical dentine hypersensitivity using different laser wavelengths: in vitro**

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**Objectives** The treatment of cervical dentine hypersensitivity using lasers with different wavelengths has been recommended in the literature. However, intrapulpal temperature rise during these treatment procedures is a major concern and there is a need for more information about the issue. The aim of this study is to evaluate the pulpal temperature rise due to laser treatment of hypersensitivity with most recommended laser wavelengths and parameters in the literature.

**Methods** Twelve maxillary central incisors were sectioned 2 mm below the cemento-enamel junction and a hole was drilled through the lingual wall of pulp chamber at cingulum level to insert a J-type thermocouple wire which is in contact with the buccal wall of the chamber. The teeth were fixed on a novel apparatus simulating pulpal blood microcirculation. Laser irradiation with three different wavelengths within the following parameters were performed perpendicular to the buccal cervical area of the teeth with the nearest distance without contact: 940 nm diode laser (1W, CW, 300µm fiber), Nd:YAG laser (100mJ, 10Hz, 1W, 100µs pulse duration, 300µm fiber) and Er:Cr:YSGG laser (0.25W, 20Hz, 700µs pulse duration, 600µm fiber). Each tooth was subjected to all three wavelengths and intrapulpal temperature rise due to laser irradiation under simulated blood microcirculation conditions were real time recorded. Finally, collected data were statistically analyzed.

**Results** Mean intrapulpal temperature rise in diode ( $5.73 \pm 1.75$  °C) and Nd:YAG laser ( $5.04 \pm 1.40$  °C) groups were comparable to each other and significantly higher than Er:Cr:YSGG ( $3.31 \pm 0.85$  °C) group ( $p < 0.05$ ).

**Conclusions** Within the limitations and parameters of this study, it was concluded that cervical dentine hypersensitivity treatment using Er:Cr:YSGG laser is more secure than 940 nm diode and Nd:YAG laser options with regard to pulpal temperature rise. The temperature rise in diode and Nd:YAG laser groups were about the critical level of 5.5 °C.

0455

**Dentin Regeneration Using Bioceramic Scaffolds, Stem Cells and Laser Irradiation**

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**Objectives** This study aimed to investigate the potential of Mg-based bioceramic scaffolds combined with Dental Pulp Stem Cells-DPSCs and application of Low Level Laser Irradiation (LLLI) to promote odontogenic differentiation and dentin-like tissue formation.

**Methods** Mg-based bioceramic scaffolds were produced by the sol-gel method with the following composition: SiO<sub>2</sub> = 60, MgO = 7.5, CaO = 30, ZnO = 2.5, all in wt %. DPSCs in cultures established from third molars of young healthy donors, were spotted at  $2 \times 10^6$  cells per scaffold. After 72h of incubation laser treatment was performed and repeated every 3 days. Cells were irradiated with a 660 nm gallium–aluminum–arsenide (Ga–Al–As) diode laser in continuous mode at 8 J/cm<sup>2</sup>. Maximum output power was about 85mW, while required irradiation time was 166 sec. Irradiation was performed in the dark, at a standard position, with the laser beam being directed towards the scaffolds. Real time PCR was used to evaluate osteo/odontogenic markers' expression after 7 and 14 days, while alkaline phosphatase (ALP) activity was measured by a p-nitrophenylphosphate (pNPP) based colorimetric assay. **Results** Exposure of the DPSCs/scaffold constructs to the proposed LLLI irradiation scheme was associated with statistically significant increase of several odontogenesis-related markers (up to 22.3-fold for BMP-2, 28.4-fold for DSPP, 4.4-fold for BGLAP, 3.8-fold for RUNX2 and 18.5-fold for osterix). ALP enzymatic activity showed a peak at day 3 for both irradiated and non-irradiated DPSCs/scaffold constructs followed by gradual decrease up to day 14. LLLI favored ALP activity at day 3 after exposure at a statistically significant level ( $p < 0.05$ ).

**Conclusions** LLLI treatment proved beneficial towards odontoblastic differentiation of DPSCs inside biomimetic Mg-based scaffolds, making this therapeutic modality promising for targeted dental tissue regeneration.

0456

#### **Dentin Regeneration Using Bioceramic Scaffolds/Dental Stem Cells/Growth Factor Constructs**

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**Objectives** This study aimed to investigate the potential of Mg-based bioceramic scaffolds combined with Dental Pulp Stem Cells-DPSCs and growth/morphogenetic factors (Dentin Matrix Protein-DMP-1 or Bone Morphogenetic Protein-BMP-2) to promote odontogenic differentiation and dentin-like tissue formation.

**Methods** DPSCs cultures were established from third molars of young healthy donors. Human Treated Dentin Matrices-hTDMs were prepared from crowns of extracted third molars and demineralized in ultrasonic cleaner with EDTA. Sol-gel synthesized bioceramic scaffolds, consisting of 60 SiO<sub>2</sub>, 7.5 MgO, 30 CaO and 2.5 ZnO, all in wt %, were hosted in cavities inside hTDMs. DPSCs were spotted at 2×10<sup>6</sup> cells/scaffold/hTDMs complex and exposed to either 100 ng/ml DMP-1 or BMP-2 for 24h. Real time PCR was used to evaluate osteo/odontogenic markers' expression after 7 and 14 days (d), while Scanning Electron Microscopy-SEM and X-ray diffraction-XRD analysis were used for morphological and structural analysis of the regenerated tissues after 28 d of in culture.

**Results** A significant up-regulation of several odontogenesis-related markers was observed for DPSCs grown inside the hTDMs/scaffold constructs (up to 26-fold for BMP-2, 28-fold for DSPP, 2.2-fold for ALP and 1.8-fold for BGLAP after 14 d). Exposure of DPSCs to either BMP-2 or DMP-1 for 24h was associated with a statistically significant increase of all odontogenesis genes' expression (p<0.01). XRD analysis showed the formation of an apatite layer on the surface of the scaffolds, while SEM-EDS analysis verified the formation of a thin layer with fibrous-like appearance with the presence of elements, including Ca, S and P.

**Conclusions** Mg-based bioceramic scaffolds promoted odontogenic differentiation and dentin-like tissue formation. Moreover, DMP-1 and BMP-2 were proved beneficial to the odontoblastic differentiation of DPSCs inside the hTDMs/scaffold constructs, which makes them potential candidates for biofunctionalization on scaffold surfaces in future application for dental tissue engineering.

0457

#### **Evaluation Of Immunohistochemical Expression Of Stem/Progenitor Cells And Differentiation Markers In Inflamed/Infected Human Dental Pulp.**

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**Objectives**

Dental Pulp Stem Cells (DPSCs) are primarily derived from healthy pulp tissues of permanent and exfoliated deciduous teeth (SHED). Since there is a paucity in literature in deriving these DPSCs from unhealthy pulp, the present study was undertaken to evaluate the immunohistochemical expression of Stem/Progenitor cells and differentiation markers in formalin fixed paraffin embedded tissue sections of inflamed /infected human dental pulp of deciduous and permanent teeth.

**Methods**

30 specimens of normal and inflamed pulp extirpated during routine endodontic treatment were placed in 10% neutral buffered formalin solution for 48 hrs. The specimens were then embedded in paraffin wax and serial sections of 5µm were obtained and evaluated for its immunohistochemical expression using various stem/progenitor cell and differentiation markers (Oct 4, nestin, CD34, CD44, desmin, osteopontin and Ki-67).

**Results** Inflamed pulp tissue of permanent teeth expressed high level of nestin and osteopontin (8 out of 10). CD44 and nestin were expressed in only 3 out of the 10 inflamed pulp tissue specimens of deciduous teeth. None of the deciduous inflamed pulp showed osteopontin expression. Oct 4, CD 34, desmin and chi 67 was not expressed in any of the inflamed/infected specimens.

**Conclusions** DPSCs exist more in inflamed pulp of permanent teeth than in deciduous teeth expressing neurogenic and osteogenic differentiation potential.

0458

#### Angiogenic properties of human dental pulp cells

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**Objectives** Objective Dental pulp in immature tooth poses a clinical challenge and healing by vascularity and angiogenic potential of the tissues. This research aimed to characterize angiogenesis of human dental pulp cells in healthy and carious immature permanent teeth with the expression of the human hematopoietic progenitor cell antigen CD34.

**Methods** Material and Method In this study we have examined 30 human teeth under 3 different clinical conditions: healthy teeth, shallow and deep cavities. Teeth were extracted and immediately cut longitudinally; pulp tissue was extirpated and fixed in formalin for 24 hours at 4 °C. The specimens were embedded in paraffin, according to standardized laboratory procedure. Sections were cut at 5 µm thicknesses and stained by the streptavidin-biotin complex immunoperoxidase method. To characterize the vascularization of human dental pulp, we examined the expression of the human hematopoietic progenitor cell antigen CD34. This antibody selectively detects human CD34 antigen. The regions of interest from each section were digitized by a video camera, which was connected to the light microscope.

**Results** Results Vascular endothelium of the dental pulp showed intense positive staining for CD34 by the streptavidin-biotin complex immunoperoxidase method. This findings indicate that angiogenesis of dental pulp is process that is present in healthy teeth with single CD34 positive cell. In carious teeth these cells subsequently coalesce to form solid vascular cords inside the connective tissue, which later aggregate with the progression of the carious lesion. Pericytes were embedded within the newly formed microvessels basement membrane.

**Conclusions** Conclusions Present study demonstrated that presence of CD34 endothelial cells reveals the continuous adjustment of vessels in response to functional needs and dental tissue homeostasis. Endothelial cells play a key role in immune and inflammatory reactions by regulating lymphocyte and leukocyte movement into dental pulp.

0459

#### Osteogenic and mitogenic factors in bone development of mesenchymal stem cells derived from adipose tissue

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**Objectives** Assessment of bone differentiation *in vitro* of porcine mesenchymal adipose derived stem cells (pADSCs), under the action of BMP<sub>2</sub> (Bone Morphogenetic Protein 2) and /or TGF- <sub>1</sub> (Transforming Growth Factor-  <sub>1</sub>), on 3D printed scaffolds like roots shape. We evaluated the actions of low level doses of the BMP<sub>2</sub> and TGF- <sub>1</sub> in osteogenesis process.

**Methods** The adipose tissue pieces were harvested from 8 Vietnamese pigs. pADSCs were isolated, cultured and then characterized by immunocytochemistry and flowcytometry. pADSCs were differentiated with growth factors on 6-well plates, on 3D printed scaffolds: two wells were control (pADSCs+medium DF<sub>12</sub> 15%, pADSCs+medium DF<sub>12</sub> 10%), a well with medium osteogenic simple (OS), a well with OS+BMP<sub>2</sub>, a well with OS+TGF- <sub>1</sub> and a well with OS+BMP<sub>2</sub>+TGF- <sub>1</sub>. We used low level doses of growth factors: 10 ng/ml for BMP<sub>2</sub> and 5 ng/ml for TGF- <sub>1</sub>. Bone differentiation was noticed in optical microscopy; at flowcytometry and immunocytochemistry by expressing markers for osteopontin and alkaline phosphatase. The roots of the upper and lower porcine premolars were printed 3D from polylactic acid. The pADSCs were labeled with fluorescent stain.

**Results** At characterization of pADSCs were found the stemness characters: positivity for CD<sub>90</sub> and Sox<sub>2</sub> markers, partially positivity for CD<sub>73</sub> and Oct<sub>3/4</sub>. Under the action of the OS or OC (osteogenic complex) medium, the stem cells have become polyhedral shape and showed nodules of osteogenesis. The best results at bone differentiation were achieved with OS+BMP<sub>2</sub> and OS+BMP<sub>2</sub>+TGF- <sub>1</sub> mediums. pADSC differentiated into osteoblasts expressed markers for osteopontin and alkaline phosphatase. TGF- <sub>1</sub> added in the medium culture after the differentiation of pADSC under the action of BMP<sub>2</sub>, suggest that TGF- <sub>1</sub> inhibit the expression of osteopontin markers. The pADSC developed on and inside the 3D printed scaffold.

**Conclusions** Culture mediums OS, respectively OC+BMP<sub>2</sub> and /or TGF- <sub>1</sub> determined differentiation of pADSCs into bone, *in vitro*. The best results at bone differentiation were achieved with OS+BMP<sub>2</sub> and OS+BMP<sub>2</sub>+TGF- <sub>1</sub> mediums. pADSCs osteodifferentiated *in vitro* and cultured on 3D printed scaffold ensure the optimum conditions for their implantation *in vivo*.

0460

### **The effects of Dental X-rays on mice gestation**

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**Objectives** Many harmful effects are caused by the radiographic examination especially for the pregnant women. Bone marrow is known to be formed during pregnancy. The aim of this investigation was to determine the dose of X-rays which interferes with the development of mice's bone marrow.

**Methods** We used 48 swiss mice for experiment and they were divided into 8 groups of 6. Radiation was effected in utero on the 11th and 18th gestational days with doses of 20 (equivalent of 5 intraoral radiographs), 40, 80 and 120  $\mu$ SV. A control group, formed by 6 swiss mice, were not irradiated. After the birth of the fetuses, both of the encephalon and the vertebral column were taken for histological study. Tissue samples were fixed by immersion in formol and then prepared for light microscopy by histological methods. A bone marrow's density equal to 3 is considered as normal. If it is lower, it means that bone marrow is affected.

**Results** The number of fetuses studied histologically were 240 (102 irradiated on the 11th gestational day, 110 irradiated on the 18th gestational day and 28 from control mice). Histological studies showed that the use of the doses of 20 and 40  $\mu$ SV didn't affect the bone marrow density ( $p = \text{NS}$ ). The irradiation with 80  $\mu$ SV induced a disturbance of bone marrow cells when it is administrated only on the 18th gestational day ( $p < 0.01$ ). The same results were observed with the dose of 120  $\mu$ SV when it is administrated on the 11th day ( $p < 0.05$ ) and the 18th day of pregnancy ( $p < 0.01$ ).

**Conclusions** Our results showed that dental X-rays administrated during pregnancy alter the bone marrow. This alteration seemed to induce a disturbance of bone marrow cells.

0461

### **Effect of gingival inflammation on T cell mediated inflammatory response in patients with idiopathic uveitis**

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**Objectives** This study aimed to investigate interleukin-17 (IL-17) IL-6, IL-10 and tumour necrosis factor alpha (TNF- $\alpha$ ) levels in gingival crevicular fluid (GCF), saliva and serum samples of patients with idiopathic uveitis to evaluate whether gingival inflammation can be a possible factor in the etiology of idiopathic uveitis.

**Methods** Twenty-one patients with idiopathic uveitis ( $n=21$ ), and twenty-two systemically healthy individuals ( $n=22$ ) were enrolled in the study. Biofluid samples were collected after recording clinical periodontal parameters. Cytokine levels in the biofluid samples were determined by ELISA. Differences between the study groups were analyzed using non-parametric statistical tests and correlations between the cytokine levels and clinical periodontal parameters were assessed using Spearman's correlation test.

**Results** GCF, serum and salivary TNF- $\alpha$  IL-17A, IL-17A/E, IL-17A+F+A/F/IL-17E levels; GCF and serum IL-6 levels; salivary IL-17F levels and salivary, serum IL-17A/F levels were higher in the uveitis group than the systemically healthy individuals ( $p < 0.05$ ). However, serum IL-10 and IL-17E levels were significantly higher in the systemically healthy group than the uveitis group ( $p < 0.05$ ). Plaque and gingival index scores correlated positively with salivary and serum TNF- $\alpha$  levels ( $p < 0.05$ ). Significant positive correlations were found between plaque index scores and GCF TNF- $\alpha$  and salivary IL-17E levels and also between gingival index scores and GCF IL-17A/F ( $p < 0.05$ ).

**Conclusions** Regulatory function of T cells seems to be impaired and T helper 1 and T helper 17 driven inflammatory responses in the intraoral and systemic biofluids are altered in patients with idiopathic uveitis. Gingival inflammation may have a triggering role in the pathogenesis of idiopathic uveitis. Further studies are warranted to clarify the possible relationship between idiopathic uveitis and gingival inflammation.



0462

#### **EFFECT OF PERIODONTAL STATUS ON DISEASE SEVERITY IN PATIENTS WITH PSORIASIS**

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**Objectives** Periodontal diseases and psoriasis are the most common chronic inflammatory diseases. Both diseases are characterized by similar risk factors, co-morbidities and exaggerated immune response. The aim of this study was to investigate the impact of periodontal status on disease severity in patient with psoriasis by evaluating clinic parameters and to determine the possible association between chronic periodontitis (CP) and chronic plaque psoriasis (CPPs).

**Methods** Eighty-eight adults with CPPs (44 men and 40 women; age range 23-61 years; mean age 40.54 years) and 40 age- and gender-matched systemically healthy control subjects participated in the study. The severity of CPPs was assessed by Psoriasis Area and Severity Index (PASI) and CPPs groups were divided into two groups as suggested mild (Ps-M) and moderate-to-severe (Ps-MS). All Subjects' periodontal status as determined by plaque index (PI), gingival index (GI), probing pocket depth (PD) and clinical attachment level (CAL) were evaluated. **Results** The CAL levels of the Ps-MS group were significantly higher than the other groups ( $p < 0.05$ ). There was no significant difference in plaque index, gingival index and probing pocket depth between groups. Furthermore, there was significant correlation between CAL and PASI values in (Ps-MS) group.

**Conclusions** Periodontal diseases severity as defined by CAL was higher in the Ps-MS group. This suggests that periodontal status of patients with CPPs may be affected by psoriasis severity.

0463

#### **Midkine in Serum of Periodontitis Patients**

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**Objectives** Midkine (MK) is a heparin-binding growth factor involved in many different processes like cell growth and surviving, angiogenesis, repair, inflammation and carcinogenesis. MK has been involved in periapical lesions; however, no relation of MK with periodontal disease has been reported. The aim of our study was to investigate if MK is present in serum and saliva of patients with long time periodontal disease with the hypothesis that increased concentrations of MK could be seen in these patients compared with controls.

**Methods** From a Stockholm County study population of 1676 patients 30-40 years old in 1985, 93 randomly selected patients were re-examined and blood and saliva samples taken 24 years later. Oral health parameters were registered and serum and saliva levels of MK were analyzed using a commercial ELISA kit. The patients were classified into 3 groups: healthy, gingivitis, periodontitis. Results between the groups were statistically analyzed with SPSS 21 program, using t-test and regression analyses.

**Results** MK was not detectable in saliva, but in serum it was significantly increased in patients with periodontitis being zero in the healthy group, 263 [pg/ml] in the gingivitis group, and 1312 [pg/ml] in the periodontitis group ( $p < 0.05$ ). Regression analyses, with the end point "MK in serum" and considering all clinical and background parameters registered, showed that the explanatory variable was plaque index with OR 5.99 (CI 1.11-32.41,  $p = 0.038$ ).

**Conclusions** The levels of MK were higher in the serum of patients with periodontitis, and the explanatory factor seemed to be a higher plaque index. Further studies are needed to investigate whether MK is involved in the periodontal inflammation and destruction process and whether this could affect or reflect in general health.

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0464

**Periodontitis is associated with increased prevalence of (pre)diabetes**

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**Objectives** Early diagnosis of (pre)diabetes mellitus is essential for the prevention and/or treatment of diabetes and diabetes complications. It has been suggested that periodontitis might be an early complication of diabetes and may be a useful risk indicator for diabetes screening. In this study, HbA1c plasma levels and subsequently the prevalence of (pre)diabetes in subjects with and without periodontitis were investigated.

**Methods** From 102 moderate periodontitis patients, 59 severe periodontitis patients and 102 patients without periodontitis, HbA1c values were obtained by analysis of dry blood spots. Differences in median HbA1c values and prevalence of (pre)diabetes between the periodontitis and control group were analyzed. Multivariate analyses were performed, correcting for known risk indicators for diabetes screening.

**Results** After correction for potential confounders, the periodontitis group showed a significant higher HbA1c value (Moderate: 5.8%; range: 5.0-16.5%; Severe: 5.9%; range 5.1-10.8%) compared with the control group (5.6%; range: 4.6-9.6%;  $p < 0.001$ ). The prevalence of (pre)diabetes was significantly higher in subjects with periodontitis compared with subjects without periodontitis ( $p = 0.035$ ). In the periodontitis group, 76 (47.2%) subjects were in a pre-diabetes phase and 27 (16.8%) subjects could be diagnosed with diabetes according to the ADA-guidelines, whereas in the control group, 38 (37.3%) subjects had pre-diabetes and 11 (10.8%) of them reached HbA1c values for diabetes diagnosis. No significant difference in the prevalence of (pre)diabetes was observed when the periodontitis group was subdivided into moderate and severe periodontitis ( $p = 0.082$ ).

**Conclusions** Periodontitis is associated with increased levels of HbA1c and subsequently with an increased prevalence of (pre)diabetes. We suggest that periodontitis may be a useful risk indicator for early (pre)diabetes. Also, elevated levels of HbA1c in periodontitis patients may partly explain their susceptibility and severity of periodontitis.

0465

**DISEASE SEVERITY IN ASSOCIATION BETWEEN CHRONIC PERIODONTITIS AND CORONARY ATHEROSCLEROSIS**

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**Objectives** Over the past decades, several studies have demonstrated the relations between chronic periodontitis (CP) and coronary artery disease (CAD). Infection and inflammation are common mechanisms in these diseases. The purpose of the present study was to evaluate the possible association between chronic periodontitis and coronary atherosclerosis according to disease severity.

**Methods** Thirty-three patients with CAD (19 men and 14 women; age range 40-65 years; mean age 53.54 years) and 20 age- and gender-matched systemically healthy control subjects (C) were included in this study. The degree and severity of CAD was evaluated with the Gensini scoring systems (GS) according to the results of coronary angiography. Coronary artery disease groups were divided into two groups as suggested low (L-GS, 16 patients) and high (H-GS, 17 patients) Gensini scores. The clinical periodontal parameters [plaque index (PI), gingival index (GI), probing pocket depth (PPD), clinical attachment level (CAL), bleeding on probing (BOP)] and the other oral health characteristics were recorded.

**Results** There was no significant difference in PI, GI and BOP between groups. Probing pocket depth and CAL values were significantly higher in H-GS group than the other groups ( $p < 0.05$ ). Additionally, CAL was positively associated with severity of disease in CAD groups.

**Conclusions** The severity of coronary atherosclerosis may play an important role in the association between CP and CAD.

0466

#### **Endothelial function is improved after periodontal therapy**

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**Objectives** Periodontitis and cardiovascular disease are complex diseases associated with each other. The mechanisms that underlie the association remain poorly understood. There is evidence for a procoagulant, prothrombotic state in periodontitis, involving leukocytes, platelets and endothelial cells. A few intervention studies suggested that improving the periodontal condition by therapy could have beneficial effects on the endothelial function. The present study aimed to longitudinally assess the effects of periodontal therapy on endothelial function. **Methods** A group of moderate-to-severe periodontitis patients (n=71) received non-surgical periodontal therapy. A sub-group (n=38) was randomly assigned to systemic antibiotic administration. Blood samples were collected at baseline, and 3-, 6-, and 12-months after completion of periodontal therapy. Levels of the biomarkers of endothelial function, sE-selectin and sP-selectin, were assessed by ELISA. CRP, fibrinogen, leukocyte and neutrophil counts, and ESR were assessed in a hospital-based biochemistry laboratory.

**Results** sE-selectin levels were significantly reduced at 3 and 6 months post-therapy (24.51 ng/ml and 23.56 ng/ml) compared to baseline (26.68 ng/ml,  $P<0.05$ ). sP-selectin levels were lower at 12 months (40.28 ng/ml) compared to 6 month (45.72 ng/ml,  $P=0.004$ ) and baseline (44.67 ng/ml,  $P=0.061$ ). Fibrinogen showed a sustained reduction at 3, 6, and 12 months post-therapy (2.98 g/l, 2.94 g/l, 2.95 g/l, respectively) compared to baseline (3.08 g/l,  $P<0.05$ ). CRP, leukocyte and neutrophil counts, and ESR showed a similar trend of reduced values post-therapy, without reaching statistical significance. Remarkably, changes in the endothelial biomarkers correlated poorly with clinical improvement in periodontal parameters and were not influenced by antibiotic treatment or smoking status of the patients.

**Conclusions** After periodontal therapy, the levels of the biomarkers of endothelial function were reduced in this group of systemically healthy patients, indicating an improvement in vascular function. These results corroborate the clinical improvements of vascular function reported in the literature after periodontal therapy.

0467

#### **Wound-Healing Effect Of Hypericum Perforatum Oinment In Periodontal Surgical Wounds In Rabbits**

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**Objectives** *Hypericum perforatum*, is a medicinal plant and used for the treatment of anxiety, depression, cuts, burns, bacterial and viral disease as well as antioxidant and analgesic in traditional Turkish medicine. In addition oily extract of *Hypericum perforatum* promotes healing of surgical wounds as a result of the increase in epithelial reconstruction. In spite of this common awareness, wound healing effect by topical application of *hypericum perforatum* have not been investigated in vivo gingival wound models.

**Methods** Thirty six New Zeland albino rabbits randomly allocated into following groups; (i) olive oil as control (n=18) and (ii) *Hypericum perforatum*+olive oil as test group (n=18). Surgical wounds (4x4 mm) that consisted of epithelial-connective tissue were created with sterile blade in maxillary palatinal area in each group. The oinments prepared with test samples or oinment base were topically applied (0.2 ml, 30 sec., twice a day) on the surgical palatinal wounds in each group of animals immediately after surgery to biopsy day. After surgery; 3, 7 and 14 days 6x6mm of epithelial-connective tissue sample was excised from the revelant field without exposing bone. Surgical wound area was measured as mesiodistal (MD) and anteroposterior (AP) dimension by digital caliper clinically.

**Results** Results were expressed as means  $\pm$  SD (standard deviations). The average area of surgical wound (MD-AP) for test and control group on 3rd day was (1,51 $\pm$ 0,39mm-1,50 $\pm$ 0,82mm) and (1,36 $\pm$ 0,34mm-1,96 $\pm$ 0,34mm), on 7th day (2,07 $\pm$ 0,45mm-2,26 $\pm$ 0,46 mm) and (1,59 $\pm$ 0,66mm-1,74 $\pm$ 0,21mm), on 14th day (2,76 $\pm$ 0,50mm-3,00 $\pm$ 0,95mm) and (2,64 $\pm$ 0,69mm-2,81 $\pm$ 0,66mm) respectively. Results were assessed by one way ANOVA and considered to be significant at  $p<.05$ . There was significantly statistical inter-group differences only at AP on 7th day.

**Conclusions** In the limit of this study, the clinical use of *Hypericum perforatum* + olive oil formulation revealed better wound healing activity in scientific manner and intraoral application can be used safely for seconder wound healing after periodontal surgery.

0468

#### **Effect Of Resin Infiltration And Microabrasion Techniques On The Colour Masking Of White Spot Lesions**

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**Objectives** A carious lesion is initiated through the subsurface demineralization of enamel and presents clinically as a white spot, interfering with the aesthetics. The aim of this in vitro study was to evaluate and compare the performance of resin infiltration and microabrasion techniques on masking white spot lesions by assessing the colour change.

**Methods** Artificially-induced initial enamel caries lesions in bovine enamel were randomly assigned to four treatment groups (n=16) corresponding to the following micro-invasive treatment: Resin infiltration (Icon, DMG); resin infiltration (Excite F, Ivoclar Vivadent); microabrasion (Opalustre, Ultradent); microabrasion/polishing (Opalustre and Diamond Excel, FGM) and a control (distilled water) group. Treated samples were immersed in demineralization solution for further 10 days. CIE L\*a\*b\* colour parameters were determined using a spectrophotometer (Spectroshade Micro, MHT) at baseline, after the production of artificial caries lesions, after application of micro-invasive treatments and after further demineralization. Colour differences ( $\Delta E$ ) between two different evaluation steps were calculated.

**Results** Both of resin infiltration and microabrasion techniques showed significantly better colour match with sound enamel than untreated controls ( $p < 0.05$ , Kruskal-Wallis, post hoc Bonferroni). However, Icon presented the best masking effect among the groups ( $p < 0.05$ , Kruskal-Wallis, post hoc Bonferroni). Excite F, Opalustre and Opalustre/Diamond Excel applications exhibited similar masking performance ( $p > 0.05$ , Kruskal-Wallis, post hoc Bonferroni). Further acid attacks did not induce visually detectable colour change for all tested materials ( $\Delta E < 3.7$ ) and Icon presented the lowest means of colour change against new acid attacks ( $p < 0.05$ , Kruskal-Wallis, post hoc Bonferroni).

**Conclusions** It may be concluded that resin infiltrant infiltration is a suitable micro-invasive approach to mask white spot lesions compared to adhesive resin infiltration and microabrasion applications.

0469

#### **Association Between Body Mass Index (BMI) and Dental Caries**

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**Objectives** The aim of this study was to determine the association between Body Mass Index (BMI) and dental caries.

**Methods** The study was conducted in Kasimpasa Military Hospital Yesilyurt Outpatient Clinic. Participants were examined by two qualified dentists, according to World Health Organization (WHO) recommendations by using dental mirrors and explorers under unit light and scores of caries, missings and fillings (DMFT) were recorded. The height and weight were measured with a physician and via digital scale and ruler and BMI values were measured. BMI was categorized into three groups as normal, overweight and obese. We aimed to determine the association between experience of caries and BMI. Chi-square and Kruskal Wallis tests were used for analyzing data.

**Results** The study population included 1823 young men within the age range of 18 -25 years. All of the *participants did not have any* health problems. When the three groups of BMI were considered, DMFT scores were not significantly different in any group.

**Conclusions** Obesity is a risk factor for several diseases such as heart disease, hypertension and atherosclerosis. The prevalence of obesity has increased internationally over the last decades. Obesity and dental caries are a significant public health problem in the world. Early diagnosis and treatment of dental caries are important in both dentistry and medicine. These complex and multifactorial relations like overweight and dental caries may involve many unknown factors which warrant exploration on various population.

0470

#### **NLDS Method Clinical Performance in Secondary Caries Diagnosis**

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**Objectives** According to the epidemiological data secondary caries cause the exchange of 60% of fillings in adult patients and 70% additions in children. The aim of this study was to determine the possibility of using a new Non-linear dielectric spectroscopy (NLDS) method for the diagnosis of secondary caries in vivo. Current methods and devices for detecting dental caries have low sensitivity and specificity and are of high impact to the patient. NLDS method uses the biological activity of cariogenic bacteria.

**Methods** 61 permanent sound and carious molars and premolars in adult patients were examined. The gold standard methods are dental mirror, dental probe and radiovisiotherapy. The state of decay was evaluated by the NLDS apparatus. The NLDS device generates a small sinusoidally varying potential which is applied to the examined tooth. The tooth response was measured and it was transmitted to the computer connected to the device. Computer software controlled the measurement process and performed spectral analysis of the response signal, determining the level of as impedance nonlinear phenomena and presented the results to the operator.

**Results** The in vivo NLDS results were statistically analysed using descriptive and data mining methods. The NLDS results correlation with gold standard diagnostics methods have been thoroughly investigated. The high sensitivity and specificity of NLDS method was obtained. The following exemplary results were reported: sensitivity of 0.90 and specificity of 0.87. According to the ROC curve theory other parameters values of sensitivity and specificity were obtained from statistical analysis.

**Conclusions** Nonlinear Dielectric spectroscopy is a simple, effective, non-invasive and low-impact patient method which allows to detect the secondary caries. NLDS exhibits high sensitivity and specificity in vivo.

0471

#### **The Effectiveness Of Different Preventive Applications On Development On Caries Risk Factors In Orthodontic Patients: A Clinical Study**

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**Objectives** The purpose of this study is to determine the effectiveness of different preventive applications on caries risks of orthodontic patients.

**Methods** Total of 80 individuals (between 12-25 ages) were selected randomly from the patients who will begin to orthodontic treatment with fixed appliance. Study was consisting of four groups. Three of these experimental which 5% NaF varnish + % 0,05 NaF mouth rinse, % 1'lik chlorhexidine varnish + % 2'lik chlorhexidine mouth rinse and casein phosphate containing materials were applied and one of control only oral hygiene motivations were given. Level of *S. mutans* (MS) and *lactobacillus* (LB), visible plaque index (VPI), gingival bleeding index (GBI), saliva flow rate (FR) and buffer capacity (BC) were recorded at before the placement of appliances (T1), at 3 month (T2), at 6 month (T3) and at 12 month (T4) after the onset of treatment. The obtained data were recorded and statistically analyzed with One Way ANOVA and Tukey Post Hoc tests.

**Results** There were no statistically significant differences between groups at all time periods in terms of MS, LB, VPI, GBI, BC, and FR ( $p > 0,05$ ). There were no statistically significant differences ( $p > 0,05$ ) between time periods for all groups in all parameters ( $p > 0,05$ ).

**Conclusions** The results from the present study can be said that regular oral hygiene care applications during treatment with fixed appliances may reduce the caries risk related to the bracket base. Oral hygiene maintenance procedure is expected to provide similar protection to other protective agents. Bracket associated with caries risk of a regular oral care routine procedure during fixed orthodontic treatment of the results of the study can be said to be effective.

0472

### **Factors Associated with Caries Experience in Turkish Children: A Pilot Study**

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**Objectives:** To assess the caries experience and some background factors in 2- to 13 year-old children in the municipality of Konya, Turkey.

**Methods:** This study was carried out on 300 children (2-13 years old) of both gender who attending Dentistry Faculty and Oral Center of Konya, Turkey. Mean dfs/DMFS (decay, filling tooth surface) ds/DS and fs/FS scores were identified for every individual. The World Health Organization (WHO) criteria and radiographs were utilized to diagnose the carious status of the subjects. No new radiographs had to be taken for this survey. The subjects were examined by one calibrated examiners in a dental clinic, with drying teeth, using a plane mouth mirror and sickle probe with the aid of a dental chair light. Plaque and gingival index were also recorded. Data on age, gender, oral health habits, dental visits, parental educational status, school type and mean family income were collected by a questionnaire completed by the subjects. Chi-square and Paired-t tests were used for statistical analyze. Spearman rank correlation coefficients were used to explore the relationships between the dfs/DMFS and differentr risk factors.

**Results:** The female/male number was found 161/139. Mean dfs was found 4.12 for 2-6 age group, mean dfs+DMFS was found 7,86 for 7-13 age group (p=0.000). The Spearman's Rho Correlations of different risk factors according to age groups showed in the Table.

**Conclusions:** The study concludes that the severity of dental caries in Konya city is high and appears to be related to socio-behavioral determinants.

0473

### **Influence of resin-infiltration system on rehardening of incipient enamel lesions**

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**Objectives** The aim of this in vitro study is to evaluate the rehardening of the incipient enamel lesions by the application of the different materials, after the demineralization and remineralization cycle.

**Methods** 56 samples from 28 caries-free bovine teeth were used in this study. After the analysis of the initial microhardness values, citric acid was applied forming active enamel erosion lesions. After the teeth were divided into 7 groups: (control (no treatment), Clearfil SE Bond, Fissurit FX and Helioclear F as fissur sealants, Icon® as a resin infiltrant with different echng times of 60, 90 and 120), all specimens were submitted to a pH-cycling regimen for 1 week. Then the teeth were sectioned and evaluated quantitatively by cross-sectional microhardness testing. Each surfaces were measured again by a microhardness tester with a Vickers diamond. Indentations were made on 5 depths of 20, 30, 50, 70 and 90 µm on each sample. Data were analyzed by one way ANOVA and post hoc Tukey test (p<0.05).

**Results** Significant changes between initial microhardness values at 20 µm , 30 µm, 50 µm and 70 µm except Clearfil SE Bond were observed. There was no statistical difference between the initial microhardness values and the mean microhardness values of samples at 90 µm indicating that all materials was insufficient for the rehardening at this depth.

**Conclusions** This in vitro study demonstrated that resin infiltration may increases micro-hardness at 20 µm, 30 µm, 50 µm, 70 µm, indicating that some material might be suitable for the treatment of enamel subsurface lesions.

0475

### **The Evaluation of the Effects of Different Remineralization Agents on Bovine Enamel Surface**

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**Objectives** Modern dentistry aims to reduce the risk of dental caries in individuals by a non-invasive and preventive treatment approaches preserving natural tooth structure. Recently, it becomes important that demineralized enamel

can be remineralized without any restorative treatment. Different remineralization agents are used for increasing the resistance against dental caries or treatment of initial enamel caries lesions. Remineralization agents cause a variety of morphological changes on the enamel surface. Within this study, it is intended to be compared with fluoride and casein that used commonly in the field of remineralization, and nano-hydroxyapatite and bioactive glass materials that can be considered in this field.

**Methods** For this study 70 bovine enamel samples were divided into seven groups (n=10). The positive control group consisted of intact enamel and a negative control group consisted of demineralized enamel samples. All groups excluding the positive control group were subjected to demineralization protocol. Five of these groups were remineralized using the following remineralization agents; fluoride containing toothpaste, CPP-ACP containing toothpaste, CPP-ACPF containing toothpaste, bioactive glass containing toothpaste, nano-hydroxyapatite containing toothpaste. AFM was used for baseline readings followed by demineralization and remineralization cycle. The samples were also assessed using SEM. Data was statistically analyzed using ANOVA.

**Results** Statistical analysis showed that all the experimental groups had a significantly higher amount of remineralization than negative control group.

**Conclusions** Within the limitation of the present study concluded that; all of the groups are effective in remineralizing early enamel caries.

**0476**

#### **Demineralization Inhibition Effect of an Orthodontic Sealant Combined with Preventive Measures**

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**Objectives** The aim of this in-vitro study was to evaluate the effect of an orthodontic sealant on tooth demineralization when combined with different preventive measures.

**Methods** Orthodontic brackets were bonded to 50 premolars using Transbond XT and then the specimens were randomly divided into 5 groups (n:10). No sealant or preventive measure was applied to the control group (T), while orthodontic sealant Ortho Coat (OC) was applied to all the other groups. OC group received no additional preventive measure, while fluoridated toothpaste (Colgate Total; TP) was applied twice a day for 2 minutes in OC+TP group, whereas the combined use of fluoridated toothpaste and fluoridated mouthrinse (Colgate Plax; M; OC+TP+M) and the toothpaste and CPP-ACP/F (MI Paste Plus; MI), (OC+TP+MI) were applied once a day in the other groups. After 4 weeks, the specimens were subjected to pH-cycling for 4 weeks. Vickers microhardness measurements (HV) were performed at 200 µm cervically of the bracket, at depths of 20 µm, 30 µm, 50 µm and 70 µm using a microhardness tester (Buehler). Data were statistically analyzed using repeated ANOVA and post hoc Bonferroni tests (p<0.05).

**Results** At the depth of 20 µm control group T revealed significantly lower HV than all the other groups (p<0.001), while no significant difference was observed among the other groups (p>0.05). At the depth of 50 µm, OC+TP+M and OC+TP+MI groups showed higher HV compared to T and OC groups (p<0.01), whereas at 70 µm, OC+TP+MI had significantly the highest HV than all the other groups (p<0.01).

**Conclusions** Orthodontic sealant Ortho Coat may protect the superficial layer of the enamel against demineralization whereas MI Paste Plus application is required for deeper layers.

**0478**

#### **Effectiveness of Different Remineralization Agents For Treatment of White Spot Lesions: A Randomized Controlled Trial**

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**Objectives** To determine the effectiveness of four different methods in treating white spot lesions (WSL) during orthodontic treatment with fixed appliance.

**Methods** Fifty eight patients who were undergoing orthodontic treatment were invited to participate in this

randomized clinical trial. The WSL index (Gorelick et al) was used to evaluate the labial surface of all anterior teeth at enrollment (600 teeth). According to index classification, this teeth which shown slight and severe WSL were evaluated with DIAGNOdent pen (DD) at baseline (239 teeth). Twenty nine subjects with a total of 218 teeth with DD values > 0 were included study (T0). The subjects were divided into four groups: Control group (7 subject, 54 teeth); Fluoride varnish (FL-V) group (8 subject, 59 teeth); Chlorhexidine varnish (CHX-V) group (7 subject, 54 teeth) and CPP-ACP group (7 subject, 51 teeth). The intervention period was 6 months, total study period was 12 months. The labial surfaces of the anterior teeth were assessed by the use of a DD at baseline (T0), 6-month (T1) and 12-month (T2) follow-up visits. The DD readings were allocated to three different groups based on WSL severity: mild (1-3), moderate (4-6) and severe ( $\geq 7$ ).

**Results** The WSLs had a mean DD reading at baseline of  $3.30 \pm 1.66$  in control group,  $3.50 \pm 2.41$  in FL-V group,  $3.55 \pm 1.94$  in CHX-V group and  $3.43 \pm 1.75$  in CPP-ACP group, respectively. The DD values of the white spot lesions decreased in all groups in intervention period (T0-T1) except for control group. The mean DD readings increased in all groups in follow up period (T1-T2). There were statistically significant differences between the mean DD readings of the Control and CPP-ACP groups ( $p=0.002$ ); FL-V and CPP-ACP groups ( $p=0.035$ ), CHX-V and CPP-ACP groups (0,017) at T1. There were no statistically significant differences was found between all groups at 12 months measurement (T2). The highest improvement rate was observed for CPP-ACP group (%58.8) at T1.

**Conclusions** The daily usage of CPP-ACP can be more effective than other preventive protocols for treatment of WSL. Only fluoride gel application seems to be inadequate for regression of WSL during orthodontic treatment with fixed appliance.

**0479**

#### **Effect of tricalcium phosphate (TCP) containing bristles of toothbrushes on remineralization of artificial carious enamel lesions**

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**Objectives** It was the aim of this study to investigate the effect of TCP containing bristles of toothbrushes on the remineralization of artificial enamel carious lesions.

**Methods** Twenty-four caries free extracted human premolars were divided into 4 groups of 6 teeth each. A 4x4 mm window on the buccal and lingual surface was demineralized and the buccal window was subsequently brushed in a brushing machine simulation a total brushing time of 1 year. Group 1 was brushed with a control toothbrush and toothpaste without fluoride; group 2 was brushed with a control toothbrush and an amine fluoride containing toothpaste; group 3 with the TCP toothbrush and fluoride free toothpaste and group 4 with the TCP toothbrush and amine fluoride containing toothpaste. The lingual window served as untreated control. Serial sections were cut through the lesions and investigated with polarized light microscopy (PLM) and scanning electron microscopy combined with electron dispersive spectroscopy (EDS). The extension of the lesion as well as the surface layer was measured. The Ca content was determined within sound enamel, the body of the lesion and the surface enamel layer. All data were compared statistically.

**Results** No statistically significant differences were found between the control windows and the treated windows regardless of the toothbrush and toothpaste. Measurement of the Ca content revealed a decreased Ca content within the body of the lesion and an increased Ca content in the surface layer but with no significant differences between the groups.

**Conclusions** The results might indicate that TCP containing bristles of toothbrushes have no advantage over conventional bristles.

**0480**

#### **Calcium Release From Bioactive Glass On Dentine. *In-vitro* ISE Comparison**

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**Objectives** The remineralization of dentine by bioactive glass (NovaMin) containing products requires release of calcium ions. Real-time measurement of calcium ion release from toothpastes applied onto dental hard tissue surfaces involves kinetic studies often requiring complex spectroscopic equipment. Previously, calcium ion



selective electrodes ( $\text{Ca}^{2+}$ -ISEs) have been used to measure calcium ion release from dental hard tissues under artificial caries conditions. The aim was to develop similar computer interfaced  $\text{Ca}^{2+}$ -ISEs to allow continuous measurement of "free" calcium ions released into water from NovaMin containing bioactive glass products previously applied onto sound and carious root dentine surfaces, for kinetic/thermodynamic analyses, to compare cariostatic efficacy.

**Methods** Extracted teeth with sound, and carious root dentine surfaces were selected, the crown and apical regions removed, and coated with acid-resistance nail varnish leaving 2mm x 2mm areas of either sound or carious root dentine surfaces exposed. Test areas were treated with either 5% NovaMin dentrifice applied by 2min brushing, or 15% NovaMin paste applied for 10s. Control areas of sound or root dentine surfaces were similarly treated with 1450ppm  $\text{F}^-$  toothpaste. All areas were rinsed with deionized water, and the samples immersed in 30mL of stirred deionized water ( $\text{pH}=7.0$ ).  $\text{Ca}^{2+}$ -ISEs (Nico2000, UK) were calibrated using  $\text{CaCl}_2$  solutions made from analytical grade chemicals, and used to continually measure the increase in free calcium ion concentration every 60s for 25h. The calibrated calcium release data was plotted as a function of time in order to compare the efficacy of each treatment on sound and carious dentine.

**Results**  $\text{Ca}^{2+}$ -ISEs can continually measure increases in free calcium ion concentration from NovaMin treated sound and carious dentine surfaces. These time dependent data showed that calcium ion release was approximately linear with respect to time, (after an initial stabilisation period) for both types of NovaMin treatment on sound and carious dentine.

**Conclusions** ISEs provide a rapid and convenient means to compare the kinetics of calcium ion release from different NovaMin treated sound and carious dentine surfaces, important for the measurement of the efficacy, and the aetiology of different bioactive glass treatments.

0481

**Dentin abrasiveness of various desensitizing toothpastes**

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**Objectives** It was the aim of this study to compare the abrasiveness of various commercially available toothpastes which claim to reduce dentin hypersensitivity.

**Methods** Of 70 human extracted molars dentin discs were prepared. The discs were etched with lemon juice for 5 minutes and one half of the discs were covered with aluminum tape. Then they were brushed with 6 different toothpastes simulating a total brushing time of 6 months. As negative controls served discs which were brushed with tape water only. Toothpastes were containing pro-arginin and calcium carbonate, strontium acetate, stannous fluoride, zinc-carbonate and hydroxyapatite, new silica, or tetrapotassium pyrophosphate and hydroxyapatite. After brushing the height difference between the control halves and the brushed halves was determined with a profilometer and statistically compared using the Mann-Whitney-U test for independent variables.

**Results** A significant difference ( $p < 0.001$ ) of the height difference between the controls and the toothpastes was found for all, except the stannous fluoride ( $p = 0.583$ ) containing toothpaste. The highest abrasion was found in the zinc-carbonate and hydroxyapatite containing toothpaste, the lowest in the toothpaste containing containing pro-arginin and calcium carbonate.

**Conclusions** Desensitizing toothpastes with different desensitizing ingredients have different abrasiveness which may have a negative effect on their desensitizing ability over a longer period of time.

0482

**Primary stability of miniscrews inserted with three different methods**

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**Objectives** The aim of our study is to compare the primary stability and loading values of miniscrews applied with three different methods; which are Er:YAG laser pilot hole application, pre-drilling and self-drilling.

**Methods** 72 miniscrews were placed into bone specimens prepared from ilium bone of bovine. For the purpose of quantifying the cortical thickness and density of bone specimens, computer tomography (CT) images of bone specimens were obtained and evaluated before miniscrew application. Miniscrews were divided into three groups containing 24 miniscrews. First group was prepared with 1.3 mm drill diameter with a length of 4mm in depth, second group was treated with Er:Yag laser with a spot size 1.3 mm, 10 mm away from bone surface, pulse energy 300mJ, pulse duration 60 seconds and 12 Hz frequency and air-water spray 40-50 ml/second. The last group was self-drilling. All of the miniscrews in the study were applied with modified torque screwdriver (Checkline TSD-50) and maximum insertion and removal torque values were recorded.

Values were statistically analysed with NCSS Statistical software. Besides descriptive statistics, one-way ANOVA, Tukey multicomparison test for multigroup comparisons, t test for two group comparison were used. Results were evaluated at  $p < 0.05$  level.

**Results** The maximum insertion and removal torque means of Self-Drilling, Pre-Drilling and Laser groups presented statistically significant difference ( $p = 0.0001$ ). Self-drilling group had higher maximum insertion and removal torque means compared to Pre-drilling and Laser groups ( $p = 0.0001$ ). Maximum insertion torque means for Pre-drilling group was higher than Laser group ( $p = 0.01$ ); however, there was no difference between Pre-drilling and Laser groups for removal torque values ( $p = 0.536$ ).

**Conclusions** Laser drill as used in the settings in our study is advantageous for primary stability of the miniscrew when compared to drill and selfdrill in going through 1.5 to 2 mms of cortical bone.

0483

**Mandibular hypomobility caused by coronoid hyperplasia in artrogryposis multiplex congenita**

Bal Küçük, B.<sup>1</sup>, Güler, N.<sup>2</sup>

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**Objectives** Mandibular hypomobility results from many disorders affecting the stomatognathic system.

Arthrogryposis multiplex congenita (AMC) is a rare disorder and a systemic condition involved in mandibular hypomobility.

**Methods** We presented a case of a 13-year-old girl diagnosed with AMC with mandibular hypomobility caused by coronoid hyperplasia.

**Results** Notably few cases of AMC with limited mouth opening and reduced range of jaw movement have been described in which this restriction has been attributed to involvement of the coronoid process.

**Conclusions** The case was presented to highlight the clinical and three dimensional cone beam computed tomography findings of AMC patients.

0484

**Epithelial specific *Runx1* knock-out causes enamel hypoplasia in mouse**

Sarper, S. E.

Osaka University Graduate school of Dentistry

**Objectives** Enamel is one of the main tissue for making up the tooth and has the hardest combination in human body. Many genes are involved in enamel formation. If enamel formation altered human disease named enamel hypoplasia may occur. We have already discovered that epithelial elimination of *Chfb* which is one of the co-factor of *Runx* gene family result in enamel hypoplasia in mice. In this study we focused on the role of *Runx1* which is another representative *Runx* family transcription factor during tooth development. Since it has been known that *Runx1* expression was observed only at dental epithelium we hypothesize that *Runx1* is involved in enamel formation. In order to investigate how *Runx1* gene in the dental epithelium effects enamel formation and ameloblast differentiation. This research aim to investigate how *Runx1* gene in the dental epithelium effects enamel formation and ameloblast differentiation.

**Methods** We generated epithelial specific knock out mouse using Cre-loxp (K14 Cre *Runx1<sup>fl/fl</sup>*) system. Mineralized tissue was examined through micro-CT observation. In order to reveal histological defect of *Runx1* cKo mice we performed hematoxylin-eosin staining on frozen sections from dissected maxilla and mandible. For observing detailed enamel prism structure, electron micrographs was used to analyze from the surface of epoxy resin embedded tooth of adult mice.

**Results** From gross morphological analysis of incisor teeth we revealed excessive attrition at tips of *Runx1* cKo incisors. Through micro-CT analysis we discovered shorter incisor in *Runx1* cKo mice. Electron micrographs showed that increased abrasion on occlusal surface of molars as well as incisors in *Runx1* cKo mice than control mice. Additionally enamel prism structure is obviously disturbed in *Runx1* cKo mice. Moreover histological analysis uncovered that *Runx1* cKo mice have retarded enamel formation and marked defect of ameloblast differentiation.

**Conclusions** *Runx1* gene in dental epithelium is critical for ameloblast differentiation and enamel formation.

0485

**The regenerative approach of salivary gland using the microenvironment of induced pluripotent stem cells**  
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**Objectives** Stem cell therapy is expected to be one of the promising methods for the compensation of lost organs. Recent researches have reported many approaches to differentiate ES or induced pluripotent stem (iPS) cells to various tissues. Stem cells have the capacity for self-renewal and multipotent differentiation. It is well known that stem cells affect a microenvironment, known as a stem cell niche. Most reports regarding iPS cell are trying to differentiate iPS cells to many tissues such as bone and spinal marrow. However, a microenvironment around iPS cells was not investigated yet. Here we focused on the niche of iPS cells and salivary gland cells to get the hint for the regeneration of salivary glands.

**Methods** E13.5 Submandibular glands (SMG) were treated with trypLE, and the dissociated cells were seeded on U-bottom plate with or without GFP-iPS cells. Then, the cells were cultured with DMEM/F12 for 96 h, regenerated SMG consisted of many acinar-like structures. The morphology of regenerated SMG was analyzed to investigate the effect of GFP-iPS cells on SMG cells. And to evaluate the differentiation of SMG cells, embryonic stem cell markers and salivary gland markers were used for qPCR and immunohistological analysis.

**Results** Coculture of embryonic SMG cells and iPS cells have better-developed epithelial structures and fewer undifferentiated specific markers than monoculture of embryonic SMG cells.

**Conclusions** We found that co-culture of embryonic SMG cells and iPS cells have more developed epithelial structures than mono-culture of embryonic SMG cells. These results suggest that iPS cells have a potential ability to accelerate differentiation for salivary gland development. Now we are trying the co-culture of adult SMG cells and iPS cells for regenerative medicine. Our finding has new insights for the future regeneration research of organ such as salivary glands.

0487

**Effects of LLLT on the Biostimulation of Surrounding Soft Tissues in BRONJ**

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**Objectives** To investigate the effects of low level laser therapy on the prevention of cellular dysfunctions induced by zoledronic acid (ZA).

**Methods** Culture wells, coated basally with 20-50 µm-thick biomimetic octacalcium phosphate, were prepared. Absorbed ZA group was formed by incubating the culture wells for 2 hours with and without 30 µM ZA. Gingival tissue samples were collected and cultured. 810 nm Ga-As diode laser, was applied to the culture wells 0.4 W for 75 sec on day 2, 150 sec on day 3 and 300 sec on day 4. RNA was extracted from the culture wells at the 48th and 96th hours using Ambion PureLink® RNA Mini Kit (Qiagen, Hilden, Germany) according to the standard protocol. Collagen type I and MMP3 expressions, cell morphology and cell apoptosis were evaluated.

**Results** WST-1 method revealed significant decreases in gingival fibroblast numbers in ZA-containing groups in days 2, 3 and 4. In the analysis of Type 1 collagen synthesis at hours 48 and 96, ZA-containing groups were measured to have significant decreases in type 1 collagen quantity. Prominent increase in MMP-3 levels was determined in the ZA-containing and LLLT- applied group. Transmission electron microscope analysis revealed no changes in cell quantity or morphology in the specimens of ZA-containing and LLLT-applied groups.

**Conclusions** It is found that ZA has negative effects on fibroblast proliferation and viability in the long term, yet its toxic effects could not be prevented with the application of LLLT. ZA represses the production of Type I Collagen in the early period and this effect lessens in later stages, but the expected biostimulation effect of LLLT is low. ZA has a toxic effect on MMP3 production and this effect could not be overcome with the application of LLLT.

0488

#### **Delivering drugs to the oral mucosa**

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**Objectives** The oral mucosa is an area increasingly recognised for delivering drugs for treating both local and systemic conditions. While the permeability and abundant vasculature are helpful, chewing and salivary flow can reduce the benefits of delivering drugs to this site. Local application of doxycycline, which inhibits matrix metalloproteinase activity and has potential as an inhibitor of mucosal inflammation, has been developed by this research group. The aim of this study was to develop hydrogels that could improve the delivery of doxycycline to the oral mucosa.

**Methods** Hydrogel formulations were evaluated with respect to viscosity, muco-adhesive capacity, and in-vitro release of doxycycline from the hydrogel as well as effects on mucosal inflammation.

**Results** Some tested hydrogels had good mucoadhesion and slow but constant zero order drug release. Incorporating doxycycline into a muco-adhesive hydrogel was found to be a successful treatment for minor aphthous ulcers with 70% of treated ulcers healing by the third day of treatment compared with 25% of placebo controls ( $p < 0.005$ ) and pain being reduced by the end of day 1. Altering mucoadhesive polymers in the hydrogels showed significant ( $p < 0.001$ ) improvement in the mucoadhesion capacity.

**Conclusions** Some clinical trials have already been conducted by this research group using hydrogels for delivering active ingredients to the oral mucosa. The results of the clinical trials were sufficiently positive to stimulate further developments of the hydrogels in order to optimise the delivery of drugs, especially doxycycline, locally to the oral mucosa in order to treat a number of inflammatory and ulcerative conditions. The results have been encouraging and now require further clinical trials to confirm the effectiveness of these local oral preparations. Different dosage forms including hydrogels, buccal films, mouth washes and aerosol sprays are aimed to deliver doxycycline locally, based upon the nature of the inflammation.

0489

#### **MASSETER MUSCLE INFLAMMATION INDUCES CHANGES IN EXPRESSION OF IL-1 $\beta$ AND KCNQ2 ION CHANNELS IN IPSILATERAL TRG**

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**Objectives** It seems that various ion channels can play important part in masticatory muscles pain conditions. Since, voltage gated ion channels regulate membrane potential in sensory neurons, and voltage gated potassium channels play important part in pain processing we investigated changes in expression level of IL-1 $\beta$  and KCNQ2 ion channels in TRG after bilateral masseter muscle allodynia induced by unilateral masseter inflammation.

**Methods** Quantitative RT-PCR was performed to investigate changes in expression levels of IL-1 $\beta$  and KCNQ2 in both inflammatory and non inflammatory allodynia induced 4 days after unilateral CFA injection in rat masseter muscle.

**Results** A significant changes in expression level of both IL-1 $\beta$  ( $p < 0.05$ ) and KCNQ2 ( $p < 0.05$ ) occurred in TRG ipsilateral to inflamed masseter, while there were no significant changes in expression of IL-1 $\beta$  ( $p > 0.05$ ) and KCNQ2 ( $p > 0.05$ ) in contralateral TRG.

**Conclusions** These results suggest involvement of KCNQ2 and IL-1 $\beta$  at primary neuronal level in inflammatory masseter muscle pain condition.

0490

#### **Effect of storage temperature and pH on dentin protease activity**

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**Objectives** *Objectives:* Matrix metalloproteinases (MMPs) and cysteine cathepsins are in part responsible for the collagen degradation in hybrid layers created by dentin adhesives. The aim of this study is to evaluate the effect of storage pH and temperature on the MMP or cathepsin-mediated dentin degradation.

**Methods** *Materials and Methods:* One hundred extracted third molars were used to prepare dentin beams. Beams (1x2x6mm) were completely demineralized in 10% phosphoric acid (24h). After baseline measurements of dry mass, beams were divided into 10 groups (n=10/group). The beams were incubated in 1mL calcium and zinc containing artificial saliva at pH 4, 6, 7.2, 9 and 11 and stored at a shaking bath either at room temperature (22°C) or 37 °C for 1 week. The group at pH 7.2 served as control. After incubation the dry weight was assessed and aliquots

of the incubation media were analyzed for pyridinoline-crosslink degradation fragment of the C-terminal telopeptide of type I collagen (ICTP) and deoxypyridinoline degradation fragment of the C-terminal telopeptide region of type I collagen (CTX) using ELISA immunoassay kits. Data were analyzed using ANOVA and Tukey's test.

**Results** *Results:* The rate of dry mass loss changed significantly between different groups ( $p < 0.05$ ). Mass loss, ICTP and CTX release were significantly higher at 37°C compared to room temperature. Both CTX and ICTP release showed a significant increase after pH 6 ( $p < 0.05$ ). Temperature showed between 3-8 fold increase in ICTP or CTX release.

**Conclusions** *Conclusions:* This study results indicate that pH of incubation solution as well as the storage temperature has significant effect on MMP and cathepsin-mediated collagen degradation of dentin.

**0491**

#### **In-vivo Prevention of Biodegradation at Dentin-Composite Interface Using CAPE**

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**Objectives** The aim of this *in-vivo* study was to evaluate the effect of caffeic acid phenethyl ester (CAPE) used as matrix metalloproteinase (MMP) inhibitor on microtensile bond strength of nanohybrid resin restoration either with total-etch or self-etch adhesive system.

**Methods** In patients aged between 12-18, ten pairs of caries-free contralateral premolars which were planned to be extracted for orthodontic treatment enrolled in the study. Two standard cavities were prepared on the occlusal surfaces of premolars. Totally four cavities in each patient were randomly divided into four treatment groups. 1) CAPE+Total-etch (Group TC) 2) Total-etch (Group T-control) 3) CAPE+Self-etch (Group SC) 4) Self-etch (Group S-control). In Groups TC and SC, 5% CAPE pretreatment was applied for 60 s before adhesive application. Cavities were restored with a nanohybrid composite (Tetric N-Ceram). All materials were applied according to the manufacturer's instructions. After three months of intra-oral functioning the teeth were extracted. Dentin-composite sticks were obtained from each restoration and used for microtensile bond strength ( $\mu$ TBS) test. Data were analyzed using repeated measures, and ANOVA.

**Results** The mean  $\mu$ TBS values for Groups TC, T, SC and S were  $38.4 \pm 14.5$ ,  $31.6 \pm 10.2$ ,  $37.5 \pm 6.8$ ,  $27 \pm 9.5$  MPa, respectively. In the groups with CAPE pretreatment with both total and self-etch adhesive groups exhibited significantly higher bond strength compared to controls ( $p < 0.05$ ). There was no significant difference between total-etch and self-etch control groups.

**Conclusions** Caffeic acid phenethyl ester pretreatment on dentin surfaces significantly increased the microtensile bond strength of nanohybrid resin restorations applied with either total-etch or self-etch adhesive system.

0492

#### Effect of dimethyl sulfoxide pretreatment on dentin permeability

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**Objectives** The objective of this study was to evaluate the effect of different concentrations of dimethyl sulfoxide (DMSO) pretreatment on permeability of demineralized dentin, determined by the amount of HEMA uptake in the demineralized dentin.

**Methods** Dentin cubes (2x2x2mm) were prepared from coronal portion of noncarious third molars. The cubes were demineralized in 0.5M EDTA (pH 7.0, 4 °C) for 20 days and rinsed in distilled water for 24 hrs. Mineralized beams served as control. After demineralization the beams were randomly distributed to ten groups (n=10/group): Group 1: Mineralized cubes (control); Group 2: demineralized cubes with no pretreatment (control); Group 3-Group 10 include pretreatment of demineralized dentin beams in ascending concentrations of DMSO (0.01, 0.1, 1, 5, 10, 20, 50, 100%) for 30 min. After that, all groups were incubated in 100% HEMA for 100 min and then removed and blotted free of excess adherent HEMA. The HEMA taken up by each cube was extracted in 2 ml of water for 1 hr. This was repeated several times and the extracts were combined. HEMA was quantitated spectrophotometrically (Shimadzu Model UV-1601). Data were statistically analyzed using Kruskal-Wallis One Way Analysis of Variance on Ranks at  $\alpha = 0.05$ .

**Results** Mineralized dentin cubes took up small amount of HEMA ( $4.71 \times 10^{-7}$  moles  $\text{mm}^{-3}$ ). Demineralized cubes incubated in HEMA (control group) ( $47.28 \times 10^{-7}$  moles  $\text{mm}^{-3}$ ) showed significantly higher HEMA uptake ( $p < 0.05$ ). DMSO pretreated cubes showed higher HEMA uptake (62.63 and  $73.25 \times 10^{-7}$  moles  $\text{mm}^{-3}$ ) compared to demineralized controls. Both 5% and 10% DMSO were significantly higher than demineralized control ( $p < 0.05$ ).

**Conclusions** The results clearly indicate that DMSO improves the permeability of dentin to HEMA. The pretreatment of dentin with 5-10% DMSO could improve the infiltration of resin monomers to demineralized dentin matrices.

0493

#### Light Intensity and Polymerization Kinetics of Hydrophilic- and Hydrophobic-rich Adhesive Phases

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**Objectives** Adhesive resin separates into hydrophobic- and hydrophilic-rich phases as it infiltrates the wet, demineralized dentin. Since visible-light is commonly used for polymerization of adhesives and composites, it is important to understand the impact of light intensity on the polymerization of the phases that develop as a result of adhesive phase separation. The objective of this study was to investigate the influence of visible light intensity on the degree of conversion (DC) and rate of polymerization of model resins representing the hydrophilic- and hydrophobic-rich phases.

**Methods** The composition (wt%) of the hydrophilic- and hydrophobic-rich phases was HEMA/BisGMA 95/5 and 45/55, respectively. Two types of photo-initiating systems, 2-component (CQ and EDMAB) and 3-component (CQ, EDMAB, DPIHP), were used. The samples were cured for 40 s using a halogen curing unit at different light intensities, i.e. 25, 50, 100, 229, 455 and 679 mW/cm<sup>2</sup>. Polymerization behavior was determined using Perkin-Elmer Spectrum 400 Fourier transform infrared spectrophotometer (FTIR) with a resolution of 4 cm<sup>-1</sup>. A time resolved spectrum collector allowed in-situ monitoring of the photo-polymerization reaction. Differences in DC and polymerization rates were evaluated using one-way ANOVA ( $p < 0.05$ ).

**Results** Low light intensities had a negative impact on DC for the hydrophilic-rich phase with 2-component PI. The incorporation of iodonium salt improved the polymerization efficiency and DC for the hydrophilic-rich phase, even at low light intensities. Although iodonium salt improved the DC of the hydrophilic-rich phase, the polymer will be susceptible to degradation due to shorter chain lengths and low cross-linking density. From the range of intensities studied here, the appropriate light intensity to obtain substantial DC (~78%) with good polymerization efficiency for hydrophilic 2PI resin is 229 mW/cm<sup>2</sup> – 679 mW/cm<sup>2</sup>.

**Conclusions** Both the hydrophobic resin and hydrophilic 3PI resin yield substantial DC with good efficiency at all of the light intensities studied here.

0494

#### **Microhardness change of bulk-fill resin composites in different increment thickness**

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**Objectives** To evaluate the top/bottom surface microhardness change (%) of a conventional and three bulk-fill resin composites in different thickness.

**Methods** Microhardness evaluations and hardness change were determined on specimens of the packable resin composite Solitare 2 (SOL, control group) and the bulk-fill resin composites Sonicfill (SNF), Filtek Bulk Fill (FBF), and Tetric EvoCeram Bulk Fill (TEBF). Seven specimens (n=7) of each material type were prepared in cylindrical stainless steel molds in different thickness (8-mm in diameter and 2-, 4- and 5-mm in thickness) and the specimens were light cured from top surface. All specimens were stored at 37°C for 24 h, before measurement. Microhardness was measured at the top and bottom surface of the 2-, 4- and 5-mm thick resin composite specimens. Data were analyzed by one-two way ANOVA using Bonferroni post hoc tests at p<0.005.

**Results** When top/bottom surface hardness change of materials were evaluated for 2-mm thickness, significantly lowest hardness change was observed in SOL group (p<0.001) which was not significantly different from SNF (p=0.143). Significantly different hardness change was observed between SNF and TEBF (p<0.005) for 4-mm thickness. No significant hardness change was observed between other materials tested (p>0.005). When hardness changes were evaluated in 5-mm thickness, highest hardness change was observed in TEBF which was significantly different from FBF and SNF (p<0.001).

**Conclusions** Increasing the increment thickness generally decreased the bottom surface microhardness values of the bulk-fill resin composites. But SNF and FBF had the lowest top/bottom surface hardness change with the increased increment thickness among the composites examined.

0495

#### **Evaluation of Hardness Development of Bulk Fill Composites at Two Time Intervals**

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**Objectives** The aim of the study was to examine hardness changes and bottom/top hardness ratio of high-viscosity bulk fill composites prepared in specific increments and to compare with a conventional composite at two time intervals.

**Methods** Two high-viscosity bulk fill composites [Sonic Fill (Kerr)(SF), Xtra Fil (Voco)(XF)] and one conventional composite [Grandio (Voco)(GD)] were used in the study. The conventional composite was chosen because it is considered as a reference for the physico-mechanical properties. The test specimens were made using a 6mm diameter x 2mm height teflon mold for GD, 4mm height mould for XF and 5mm height mould for SF. The mould height complies with the maximum increment thickness specified by the manufacturer. Each sample was supported on a glass slide to obtain a smooth surface on the composites. Twenty samples were prepared from each composite and divided into two groups (n=10). The samples were cured using Demi Plus LED (Kerr Corp.,USA) from the top for 20s and 40s according to the groups. Microhardness properties of the samples were measured using Highwood HWDM-3 (TTS Unlimited Inc., Japan) at the top and bottom immediately post cure and after 24 h of storage in distilled water at 37°C. The results were analyzed by one-way ANOVA, Tukey HSD and Paired Samples T Test (p<0,05).

**Results** The microhardness values of SF and XT groups were found similar to each other and significantly lower than GD group. All samples showed significant increase of microhardness after 24h of storage in distilled water compared to initial values. Bottom/top microhardness ratio found higher than %80 for all groups.

**Conclusions** Although the tested high-viscosity bulk fill composites hardness values were lower than conventional composites, the similarities in hardness developments and bottom/top hardness ratio of their specific increments at two time intervals seems to be beneficial for the clinical use of these composites.



0496

# **Surface roughness and microhardness of bulk-fill and low-stress restorative composites**

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**Objectives** The aim of this in vitro study was to compare the surface roughness and microhardness of bulk-fill and low-stress nano-filled and nano-hybrid restorative composites with a conventional microhybrid composite.

**Methods** Two nanohybrid bulk-fill composites; Sonic Fill (Kerr; SF), Tetric N-Ceram Bulk-Fill (Ivoclar/Vivadent; TB), one nano-filled bulk-fill composite; Filtek Bulk Fill (3MESPE; FB), two low-stress nanohybrid composites; Kalore (GC; K) and Charisma Diamond (Hereaus; CD) and a reference conventional microhybrid composite (Filtek Z250; Z250) were tested. A total of 100 composite discs, 20 from each material (6x4 mm), were prepared using teflon molds and then polymerized with a LED curing unit (Demi Ultra, Kerr) according to the manufacturer's instructions. Following storage in distilled water for 24 hours at 37°C, the specimens in each composite group were randomly divided into two groups (n=10) according to the tested parameters. Surface microhardness (HV) of the specimens was determined using a digital microhardness tester (Buehler) while surface roughness (Ra) was evaluated after wet polishing of the specimens with the two step polishing system Enhance/POGO (Dentsply) with a profilometer (Perthometer M1 Mahr). Data were statistically analyzed with one way ANOVA and post hoc Tukey's tests (p<0.05).

**Results** Different superscript letters in each row indicate significant differences at (p<0.05).

**Conclusions** Conventional microhybrid composite created smoother surfaces than the nano-filled and nano-hybrid bulk-fill and low-stress composites. Within the class of bulk-fill and low-stress composites microhardness showed large differences which were similar or lower than the microhybrid composite.

Mean HV and Ra values of tested composites

Evaluated Parameters	Composites					
	SF	TB	FB	K	CD	Z250
HV	106.5±2.95 <sup>c</sup>	87.69±1.02 <sup>b</sup>	88.09±1.47 <sup>b</sup>	74.53±5.68 <sup>a</sup>	104.9±1.97 <sup>c</sup>	101.71±0.71 <sup>c</sup>
Ra	0.49±0.07 <sup>c</sup>	0.32±0.12 <sup>b</sup>	0.46±0.05 <sup>c</sup>	0.34±0.09 <sup>b</sup>	0.47±0.03 <sup>c</sup>	0.198±0.02 <sup>a</sup>

0497

# **Evaluation of Surface Roughness of Different Bulk-Fill Composites After Polishing**

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**Objectives** The purpose of this study was to investigate the effect of polishing systems on surface roughness of different bulk-fill composites.

**Methods** The bulk-fill composites SonicFill, Filtek Bulkfill, Tetric EvoCeram Bulkfill and Solitare 2 (Control) were evaluated. A total of 112 specimens (8 mm in diameter, 2 mm in thickness) were fabricated in a metal mold covered with a Mylar strip. After polymerization, seven specimens per group received no polishing treatment and served as the control. For each composite group, the specimens were randomly divided into three polishing systems: Sof-Lex, Enhance, Onegloss (n=7). All polishing systems were applied according to the manufacturers' instructions after being ground wet with 600, 800 and 1200 grid silicon carbide paper. The surface roughness values were determined using a profilometer. Statistical analyses were performed by using two-way ANOVA and Tukey HSD tests for multiple comparison at a significance level of p<0.002.

**Results** All of the control groups exhibited the significantly minimum surface roughness values (p<0.001). When the resin composites were compared, the most smooth surface was observed in Solitare 2 (Control) group polished with Sof-Lex discs while the most rough surface was determined in Filtek Bulkfill polished with Sof-Lex discs.

**Conclusions** Mylar strip produced lowest surface roughness on all composite material. The effect of polishing systems on surface roughness values was dependent on both composite material and polishing systems.

0498

# **Indentationmodulus of two bulk-fill resin-based composites under simulated clinical conditions**

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**Objectives** To assess the effect of irradiation time and distance of the light tip on the Indentationmodulus (E) of two bulk-fill resin-based composites at simulated clinically relevant filling depth.

**Methods** Indentationmodulus was assessed at varying depth (0.1 to 6 mm in 100 µm steps), irradiation time (10, 20 or 40 s, 1703 mW/cm<sup>2</sup>) and distance away from the light tip (0 and 7 mm).

**Results** A Student's t-test analysed the differences of E in 0.1, 2, 4 and 6 mm depths, when the distance between curing unit and specimen's surface increase from 0 to 7 mm. E ranged from 9.5±2.0 GPa to 15.4 ± 1.3 GPa for x-tra base and from 6.7 GPa±3.0 to 14.8 GPa±0.4 for Tetric EvoCeram Bulk Fill. The influence of material on E was significant ( $r^2=0.080$ ) while the parameters irradiation time, distance from the light tip and depth emphasise a stronger influence on Tetric EvoCeram Bulk Fill.

**Conclusions** Both materials can be used in one step of a procedure to fill at least 4mm thick increments under clinically relevant curing conditions. Therefore, they allow a simplified and timesaving filling technic.

Indentationmodulus

Indentationmodulus(GPa)												
Time (s)	Depth: 0mm			2mm			4mm			6mm		
	0	7	p	0	7	p	0	7	p	0	7	p
Tetric EvoCeram Bulk Fill												
10	12.2(1.0)	12.3(1.3)	0.780	13.5(0.4)	13.9(0.6)	0.047	12.8(0.4)	12.7(0.5)	0.504	9.3(2.2)	6.7(3.0)	0.008
20	12.6(1.0)	12.0(1.2)	0.106	14.5(0.5)	13.4(0.5)	0.000	14.1(0.3)	12.8(0.3)	0.000	11.8(0.9)	10.1(1.8)	0.001
40	13.5(0.6)	12.7(1.0)	0.012	14.7(0.6)	14.8(0.4)	0.757	14.3(0.6)	14.4(0.3)	0.420	13.3(0.8)	12.7(0.7)	0.014
x-tra base												
10	14.1(2.4)	12.2(0.9)	0.003	15.4(1.3)	13.5(0.6)	0.000	15.0(1.0)	12.8(1.0)	0.000	13.0(2.2)	9.5(2.0)	0.000
20	13.2(1.4)	12.2(1.8)	0.068	14.6(0.6)	14.6(0.7)	0.852	14.6(0.5)	14.2(0.6)	0.037	13.5(1.2)	11.0(1.8)	0.000
40	13.4(1.7)	12.1(1.3)	0.013	14.2(1.0)	14.0(0.7)	0.697	14.6(0.9)	14.3(1.1)	0.470	13.3(1.0)	12.7(1.4)	0.181

0499

# **Transparency Transition: A New Option For Bulk Filling Composites**

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Ivoclar Vivadent

**Objectives** Bulk filling composites guarantee a layer thickness of at least 4 mm. To obtain this layer thickness, these composites have a high transparency to secure the curing at the bottom of the filling. Because of the high transparency, the aesthetics of these fillings are limited. A new method to get an aesthetic filling with high curing depth is transparency transition during curing. The uncured composite has a high transparency; during curing the transparency decreases because of change in the refractive index of the monomer matrix. A composite with this new technology (Tetric EvoFlow Bulk Fill) is compared with other flowable bulk filling composites on the market. The change of transmission of light through the composite during curing and the transparency of the composite before and after curing were measured.

Methods 5 different flowable bulk composites were evaluated: Tetric EvoFlow Bulk Fill TEF (Ivoclar Vivadent), SDR (Dentsply), Venus Bulk Fill (Heraeus Kulzer), X-tra base (Voco), and Filtek Bulk Fill Flowable Restorative (3M/Espe). To measure the light transmission, the entrance of an Ulbricht's sphere was covered with a cylinder ( $\varnothing = 6$  mm,  $h = 4$  mm,  $n = 5$ ) and filled with the composites. The bottom surface was lined with transparent matrix tape. The radiometric signal was recorded during curing of the composites with a Bluephase style (Ivoclar Vivadent) for 10 s or 20 s. For the measurement of the transparency of the uncured composite, a bulb ( $20 \times 20 \times 1$  mm,  $n = 3$ ) was filled; for the cured composite, a disc ( $\varnothing = 20$  mm,  $h = 1$  mm,  $n = 3$ ) was polymerized (2x3min Spektramat). Both were measured in the Spectrophotometer Minolta CM-5.

Results All composites showed a change in transparency and light transmission during polymerization. TEF is the only composite which showed a reduction in transparency and light transmission during curing.

Conclusions With an optimized selection of filler and monomers, bulk composites with tooth-like transparencies are possible.

## Results

	Transparency / %		Radiometric Signal / mW	
	uncured	Polymerized	Curing (Start)	Curing (End)
TEF	$36.1 \pm 1.5$	$10.2 \pm 0.2$	$50.6 \pm 1.9$	$42.2 \pm 0.8$
SDR	$11.5 \pm 0.5$	$18.5 \pm 0.5$	$40.6 \pm 1.7$	$61.9 \pm 4.1$
Venus BF	$14.9 \pm 0.7$	$47.0 \pm 2.0$	$49.2 \pm 3.3$	$93.1 \pm 2.7$
X-tra	$25.7 \pm 1.0$	$21.3 \pm 0.7$	$66.3 \pm 2.5$	$85.4 \pm 1.3$
Filtek BF	$13.0 \pm 0.5$	$20.6 \pm 0.6$	$47.8 \pm 1.5$	$83.6 \pm 1.9$

## 0500

### Volumetric polymerization shrinkage, microhardness and depth of cure of bulk-fill composites.

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Objectives To compare the volumetric polymerization shrinkage (VS), Vickers hardness (HV) and depth of cure (DOC) profiles of three bulk fill composites with a conventional composite.

Methods Three bulk fill composites; Tetric N Ceram Bulk Fill (TBF), SonicFill (SF), Beautifil Bulk Restorative (BBR) and a conventional composite Tetric N Ceram (TNC) were compared. The volumetric polymerization shrinkage of the composites was measured using a video imaging device (AcuVol, BiscoInc; n:10). For HV and DOC, three specimens of each composite were prepared using teflon molds with 5mm in diameter and 8mm in depth and polymerized according to the manufacturer's instructions (Demi Ultra). All specimens were stored at 37°C for 24 hours in distilled water before the measurements. HV was evaluated for each specimen as a function of depth of material at 0.1mm intervals (Buehler). DOC was calculated as the 80% hardness drop-off. One way ANOVA, Pearson Correlation and Kruskal Wallis tests were performed for the statistical analyses ( $p < 0.05$ ).

Results There were statistically significant differences between the composites for the tested parameters ( $p < 0.005$ ). BBR showed the lowest VS ( $1.68 \pm 0.17$ ) while TNC resulted in the highest ( $2.49 \pm 0.27$ ) among the other composites ( $p < 0.01$ ). The maximum HV ranged from 60.87 to 114.37 N/mm<sup>2</sup>. SF exhibited the highest, whereas TNC showed the lowest HV ( $p < 0.01$ ). BBR showed the highest DOC corresponding to 80% of max HV. There were no statistically significant correlations between HV and VS values ( $p > 0.05$ ).

Conclusions Bulk-fill composites presented lower volumetric polymerization shrinkage, higher Vickers hardness and depth of cure than the conventional composite.

## 0501

### The effect of LED curing units on polymerization of bulk-fill composites.

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**Objectives** To assess how the polymerization of bulk-fill composites depends on the light intensity and spectral distribution of LED curing units.

**Methods** Composite materials Filtek Bulk Fill posterior restorative A3 (3M-ESPE), Sonic Fill Composite A2 (Kerr), Tetric Evo Ceram Bulk Fill IVA (Vivadent-Ivoclar) and flowable Filtek Bulk Fill A2 (3M-ESPE) and SDR U (Dentsply) were polymerized in a Teflon mold (4.0 mm internal diameter, 4.0 mm depth, five specimens per group) from one side using LED curing units of a lower intensity of 850 mW/cm<sup>2</sup> and a narrow emission spectrum 440-490 nm (Translux PowerBlue, Heraeus Kulzer) and a higher intensity unit of 1240 mW/cm<sup>2</sup> and a broad-dual wavelength emission spectrum 385-515 nm (BluePhase G2, Vivadent-Ivoclar). The extent of polymerization was characterized by the Knoop hardness measurement on the top and bottom surfaces of the specimens stored at 37°C for 24 hours after polymerization. The results were analyzed using Repeated measures ANOVA and Tukey HSD post-hoc tests at  $\alpha=0.05$ .

**Results** Significantly higher hardness was found on the top-irradiated surface of Sonic Fill and bottom surfaces of Sonic Fill, Filtek Bulk Fill posterior, Tetric Evo Ceram Bulk Fill and flowable Filtek Bulk Fill cured with the BluePhase G2 unit. The bottom-to-top hardness ratio for all the composite materials exceeded the 80% level usually required for adequate polymerization.

**Conclusions** Bulk-fill composites used in the study can be adequately polymerized in 4-mm increments using high-intensity LED curing units. However, increased light intensity and a broader emission spectrum of these units may improve polymerization especially of the bottom surface of the composite fillings.

## 0502

### Long term post-cure conversion of bulk-fill composites

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**Objectives** To follow the degree of conversion (DC) of two commercial bulk-fill composite materials (Tetric EvoCeram Bulk Fill and Tetric EvoCeram Bulk Fill Flow/Ivoclar Vivadent) for up to seven days post cure.

**Methods** DC was determined with Raman spectroscopy by comparing the relative change of band at 1640 cm<sup>-1</sup> to the reference band at 1610 cm<sup>-1</sup> of uncured and cured material. For each material, five samples were prepared. The cylindrical sample (d=3 mm, h=6mm) were light cured with irradiance of 1090 mW/cm<sup>2</sup> for 20 seconds. After curing, the samples of Tetric EvoCeram Bulk Fill and Tetric EvoCeram Bulk Fill Flow were stored at 37°C. DC was measured immediately after curing (0 days), 1 day post-cure and 7 days post-cure. Statistical analysis was performed using a dependent samples t-test.

**Results** DC values (%) were (0 days/1 day/7 days): Tetric EvoCeram Bulk Fill 58.3/66.4/71.5; Tetric EvoCeram Bulk Fill Flow 71.6/80.1/80.7. After 1 day post-cure, the DC increase was statistically significant for all the composites tested. Additionally, the DC increase was significant after 7 days post-cure for Tetric EvoCeram Bulk Fill.

**Conclusions** A long term post-cure DC increase was observed for both tested bulk-fill composites, suggesting that mechanical properties and biocompatibility develop gradually over at least seven days. This may be due to the alternative photoinitiator systems and polymerization modifiers used in bulk-fill materials.

## 0503

### Cure of Bulk Fill Composites with their recommended Curing Lights

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**Objectives** The objective of this work was to characterize the cure depth of dental bulk fill composites with the respective manufacturers' and other curing lights.

**Methods** Cure depth measurements (n=3) were made according to ISO 4049 with curing times per the manufacturers' instructions. Bulk fill materials tested included Filtek<sup>TM</sup> Bulk Fill posterior A3 (FBFP, 3M ESPE, 20s cure), Tetric EvoCeram Bulk Fill IVA (TECBF, Ivoclar-Vivadent, 10s cure) and Sonic Fill A3 (SF, Kerr, 20s cure). Curing devices used were the new Elipar<sup>TM</sup> DeepCure-S (3M ESPE), Bluephase Style (Ivoclar-Vivadent) and Demi Ultra (Kerr).

**Results** Composite / Curing Device / ISO Cure Depth (mm)

FBFP / Elipar DeepCure-S /  $4,37 \pm 0,06^A$

FBFP / Demi Ultra /  $4,20 \pm 0,10^{AB}$

FBFP / Bluephase Style /  $4,17 \pm 0,12^B$

Sonic Fill / Elipar DeepCure-S /  $3,57 \pm 0,06^C$

Sonic Fill / Demi Ultra /  $3,50 \pm 0,01^C$

Sonic Fill / Bluephase Style /  $3,30 \pm 0,10^D$   
TECBF / Elipar DeepCure-S /  $3,10 \pm 0,10^E$   
TECBF / Demi Ultra /  $3,20 \pm 0,10^{DE}$   
TECBF / Bluephase Style /  $2,87 \pm 0,21^F$

ANOVA analysis showed that at  $p < 0.05$ , FBFP had statistically higher cure depth independent of the LED curing light, when cured according to manufacturers' instructions. Data with the same superscript letter are statistically not different.

Conclusions Only FBFP achieved 4mm cure depth according to ISO 4049 with all tested curing devices.

Surprisingly, the multi-initiator TECBF (TPO, Ivocerin, camphorquinone) did not achieve 4mm ISO cure depth after the manufacturer's recommended curing time, even with the corresponding multi-wavelength light Bluephase Style. Cure depth of TECBF was significantly higher when cured with the mono-wavelength Demi Ultra or Elipar DeepCure-S.

## 0504

### EFFECT OF MONOWAVE AND POLYWAVE LED TECHNOLOGY ON MICROHARDNESS, TEMPERATURE RISE AND LIGHT TRANSMISSION DURING POLYMERIZATION

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Objectives To investigate the microhardness, polymerization temperature and light transmission of different bulk fill composite materials cured by polywave and monowave LED technology.

Methods Eight groups (n=5) of Tetric EvoCeram Bulk Fill (Ivoclar Vivadent), X-tra fil (Voco), Filtek Bulk Fill Posterior (3M ESPE) and Tetric EvoCeram (Ivoclar Vivadent) were prepared in Teflon moulds (5 mm in diameter and 2 and 4 mm thick) and cured with polywave Bluephase Style, 1100 mW/cm<sup>2</sup>, and monowave Bluephase Style M8, 800 mW/cm<sup>2</sup>. Temperature of the samples during illumination was measured with T-type thermocouple, light transmission with Ocean Optics spectrometer and microhardness with Vickers tester.

Results During polymerization with the monowave lamp maximal temperature rise was 6.2 °C at 2 mm and 5.2 °C at the depth of 4 mm, while these temperatures were 6.8 °C and 5.8 °C when using polywave lamp. Average temperature rise using polywave was significantly higher than with monowave ( $p < 0.05$ ) for all materials except Filtek. Microhardness was highest at the surface in comparison to 2 and 4mm depths for all tested materials while the greatest microhardness was found for X-tra fil at all depths. Average microhardness was greater when using monowave for Filtek Bulk Fill Posterior at 2 mm, Tetric EvoCeram Bulk Fill at surface and 2 mm and X-tra fil at 4 mm depth ( $p < 0.05$ ). The function of transmission vs. time shows much faster rise of transmission using the polywave lamp compared to the monowave. The saturation of transmission was reached at 2 mm but not at the depth of 4mm, for all samples and both lamps.

Conclusions Polywave LED produced higher temperature while the microhardness was almost similar when using both lamps. Optical transmission data indicates that the polymerization is not finished directly after irradiation, but after 24 h, which can be confirmed by the microhardness tests (80 % assumption).

## 0505

### Effect of temperature on mechanical properties of bulk-fill and low-stress composites

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Objectives The aim of this study was to compare the effect of temperature on mechanical properties of bulk-fill and low-stress restorative composites by determining their flexural strength (FS), elastic modulus (E) and Vickers hardness (HV).

Methods Three bulk-fill composites; Sonic Fill (SF; Kerr), Tetric N Ceram Bulk Fill (TBF; Ivoclar-Vivadent), Filtek Bulk Fill (FB; 3MESPE) and two low-stress composites (Kalore (K; GC), Charisma Diamond (CD; Heraeus-Kulzer) were tested in 3 different conditions: at room temperature (22°C), immediately removal from the refrigerator (4°C) and body temperature (37°C). A total of 300 specimens were prepared according to ISO 4049 for the tested parameters (n:30 for FS-E; n:30 for HV from each composite), polymerized regarding the manufacturer's instructions and stored in distilled water at 37 °C for 24 h before the measurements. FS and E were determined by three point bending test (Instron). HV was evaluated on the top, 2mm and bottom surfaces of each specimen (Buehler). Data were analyzed by two way ANOVA and post hoc Tukey's tests ( $p < 0.05$ ).

Results There were statistically significant differences between the mechanical properties of the bulk-fill and low-stress restorative composites. FB presented significantly the highest FS in all temperatures while K presented the lowest at 4°C and 22°C whereas no significant differences were detected between T and K at 37°C ( $p < 0.05$ ). SF and

FB showed the highest E while K and T showed the lowest at 4°C and 22°C. HV of all the tested composites were significantly different from each other, either in top, 2mm and bottom surfaces, showing SF and CD the highest, K the lowest values for all the tested temperatures ( $p < 0.05$ ).

Conclusions Temperature significantly influenced mechanical properties of bulk-fill and low-stress restorative composites with a tendency higher values at 37°C.

**0506**

**Effectiveness of new gel with nano-hydroxyapatite in reducing dentin hypersensitivity: a double-blind randomized controlled trial.**

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**Objectives** The present randomized double blind clinical trial aimed to compare the efficacy in reducing dentin hypersensitivity of a dentifrice gel formulation containing hydroxyapatite with a fluoride dentifrice gel and a placebo. In addition, an *in vitro* scanning electron microscopic (SEM) analysis was performed.

**Methods** 60 subjects were recruited to participate in the study. The inclusion criteria were: hypersensitive areas on facial surfaces of the teeth with at least two teeth scoring “pain” during application of stimulus, good periodontal health with no other conditions that might explain their dentin hypersensitivity. A computer-generated random table with blocking to one of the three study treatments was used in order to have 20 subjects per group: 1) hydroxyapatite dentifrice gel; 2) fluoride dentifrice gel; 3) placebo. Groups 1, 2 and 3 were instructed to apply the gel on the teeth for 10 minutes once a day for ten days consecutively. The participant’s dentin hypersensitivity was evaluated at baseline, after 2 and 4 weeks using airblast and tactile tests. In addition a subjective evaluation using a visual analogue scale was used. Three teeth extracted for orthodontic purposes and treated according to each treatment group were examined by SEM.

**Results** Significant lower values of cold air sensitivity and tactile sensitivity ( $p < 0.05$ ) were found for group 1 at 2 weeks and 4 weeks compared to baseline. In addition statistically significant ( $p < 0.05$ ) lower values of sensitivity were reported for group 1 compared to group 2 and 3 at 2 and 4 weeks respectively. The VAS scores were significantly lower ( $p < 0.05$ ) in group 1 at 2 and 4 weeks compared to baseline.

**Conclusions** The findings of the present study encourage the application of hydroxyapatite in tooth gel as an effective desensitizing agent providing quick relief from symptoms after 2 and 4 weeks.

**0507**

**Effect of three dessentizing agents on dentin permeability**

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**Objectives** Evaluate the effect of three desensitizing agents on reducing permeability immediately and after simulation of oral cavity’s conditions.

**Methods** Fifteen (15) extracted non-carious human third molar teeth were sectioned to obtain 0.7mm thick mid-coronal dentin disks. The specimens were assigned to three groups and treated with: 1) fluoride varnish (5% Duraphat® Colgate Palmolive, New York, United States of America) (DP); 2) toothpaste with 8% arginine in a calcium carbonate and silica-based (CG) (Sensitive Pro-Relief™ Colgate-Palmolive, NY, USA) and a 3) toothpaste containing Casein Phosphopeptides- Amorphous Calcium Phosphate (CPP-ACP) (Tooth Mousse®, GC Corp, Tokyo, Japan). All specimens were then exposed to conditions similar to the oral cavity (artificial saliva and citric acid). A modified Pashley’s hydraulic pressure system was used to measure dentin permeability at baseline, after product and after artificial saliva and citric acid. ANOVA and Scheffe’s post-hoc comparisons were used to evaluate differences among groups ( $\alpha = 0.05$ ).

**Results** The three agents showed a significant reduction on dentin permeability ( $p < 0.02$ ). The percentage of permeability reduction did not differ significantly among the three agents on the immediate, although DP had the higher permeability reduction (88%), follow by CPP-ACP (69,74%), and CG (64,04%). On each group, there is no significant change on permeability reduction comparing the three different moments. Nonetheless, the comparison of the three agents on the three moments, showed a significant difference between DP and CPP-ACP after the exposure to artificial saliva and citric acid ( $p < 0,05$ ), being DP more efficient on these later conditions.

**Conclusions** These three agents should be consider to dentin hypersensibility treatment, because of their capacity on reducing dentin permeability. After the simulation of oral cavity conditions their action is reduced but not significantly. CPP-ACP probably needs multiple applications to be efficient.

**0508**

**Microstructural Changes of Different Desensitizing Procedures applied Human Dentinal Tubules after Citric acid exposure: A SEM Analysis.**

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**Objectives** The aim of this study was to analyze the effect of acidic attack on the different desensitizing procedures including Er:YAG laser and an in-office desensitizing paste alone or their combination applied human dentinal tubules by using SEM analysis.

**Methods** Twenty-eight specimens obtained from freshly extracted impacted 3rd molars were included in this study and divided into 4 groups. All specimens were exposed to 1% citric acid in 5 min. Then Group I served as the control there was no treatment applications applied, whereas group II, group III, and group IV received Er:YAG laser, a desensitizing paste (DP) containing 8% arginine and calcium carbonate and DP+Er:YAG laser combination, respectively. Afterwards all treatment groups were submerged into 1% citric acid solution for 3 hours. And then analyzed under SEM.

**Results** After 3 hours of re-immersion with citric acid occluded dentinal tubules were still observed in all groups except for the control group. Intergroup comparisons revealed statistically significant difference in favor of the combined group regarding tubule numbers/100  $\mu\text{m}^2$  ( $p < 0.05$ ).

**Conclusions** It is likely that dentine treated with DP+Er:YAG laser becomes more resistant to acidic attacks promoted by citric acid applications.

**0509**

**Effects of Desensitizers on the Microhardness of Enamel and Dentin**

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**Objectives** To evaluate the effect of desensitizing agents with different contents on human enamel and dentin surfaces.

**Methods** Seventy enamel and dentin surfaces were obtained from the buccal surfaces of extracted human non-carious incisors. The samples were embedded in acrylic resin and the surfaces were ground flat with SiC papers (600, 1000, 2500, 4000 grits), until the enamel and dentin surfaces appear together.

Teeth were randomly divided in seven groups according to the desensitizing agents applied ( $n=10$ ):

- (1) Hydroxyapatite (Teethmate Desensitizer, Kuraray),
- (2) Hydroxyapatite & Potassium nitrate (ExSense, Cavex),
- (3) Potassium nitrate & Fluoride (UltraEZ, Ultradent),
- (4) Casein phosphopeptide-Amorphous calcium phosphate (CPP-ACP) (Tooth Mousse, GC),
- (5) Arginine & Sodium fluoride (Elmex Sensitive Professional, GABA/Colgate-Palmolive),
- (6) Arginine & Calcium carbonate (Sensitive Pro-Relief Desensitizing Paste, Colgate),
- (7) Glutaraldehyde (Gluma Comfort Bond+Desensitizer, Heraeus Kulzer).

Microhardness measurements of the enamel and dentin surfaces were determined before and after application of desensitizing agents using a microhardness tester (HMV Microhardness Tester, Shimadzu) with a Vickers diamond under a load of 980.7 mN/15s. Five indentations were made on each enamel and dentin surfaces and the average values were calculated. Additionally, the percentage of microhardness change was calculated. The data were analyzed with Wilcoxon Sign and Kruskal-Wallis tests ( $p < 0.05$ ).

**Results** Kruskal-Wallis test revealed no differences for initial microhardness values of both enamel and dentin surfaces ( $p > 0.05$ ). Application of hydroxyapatite & potassium nitrate, potassium nitrate & fluoride and glutaraldehyde containing desensitizers significantly decreased microhardness of enamel surfaces. Only, arginine & calcium carbonate containing desensitizer improved the microhardness of enamel surface (1.75%). Microhardness values of dentin surfaces were decreased by hydroxyapatite & potassium nitrate, arginine & sodium fluoride and glutaraldehyde containing desensitizers, while increased by CPP-ACP paste ( $p < 0.05$ ). The microhardness recovery of dentin surfaces occurred after application of potassium nitrate & fluoride (5.02%) and CPP-ACP paste (2.68%).

**Conclusions** Desensitizers could provide comparable microhardness characteristics both for enamel and dentin surfaces.

**0510**

**The effects of prophylactic polishing pastes on dentine tubular occlusion**

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Queen Mary University of London

**Objectives** To investigate the in vitro effectiveness of six selected prophylactic pastes on dentine tubule occlusion, namely three experimental polishing pastes containing 45S5, 45S5P6, and 45S5P6F5 bioglass, Nupro® Sensodyne® ([NS]DENTSPLY International), with/without fluoride, and a base paste containing no bioglass.

**Methods** Three bioactive glasses were made as follows 1) high phosphate (45S5P6) 2) with fluoride (45S5P6F5) and 3) the basic bioactive glass (45S5). Preparation of the dentine discs (200-400 microns thick) was by sectioning mid-coronal portions of extracted teeth. A modified Pashley Hydraulic Conductance device was used to measure the fluid flow rates through the dentine discs. The fluid flow rates were measured before and after applying the prophylactic pastes, reduction in fluid flow would indicate that tubular occlusion had occurred.

**Results** There was a significant reduction of the fluid flow rates of 55.4% for NS with fluoride, and 53.6% for NS without fluoride. The experimental prophylactic pastes gave a fluid flow reduction range of 41.26-56.9%. However, there were no statistical differences between the NS products +/- fluoride. The base paste used to formulate the experimental bioglass pastes also gave a significant reduction in fluid flow of 40.41%, however there were no statistical significant differences observed when adding the bioactive glasses to the base paste. This may suggest that silica particles in the base paste were also effective in reducing fluid flow rates. The three experimental pastes had a similar tubular occlusion effect. Paired T tests demonstrated no significant differences between the prophylactic pastes.

**Conclusions** Conclusion: All the prophylactic polishing pastes were effective in reducing fluid flow through tubular occlusion as the pastes contained both the bioactive glass and silica particles with smaller diameter than the dentine tubule diameter. The results from the NS +/- fluoride pastes would suggest that the fluoride content in the pastes has no effect on fluid flow rates.

**0511**

**Clinical evaluation on the efficacy of a newly developed air polishing powder in reducing dentin hypersensitivity**

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**Objectives** To compare the clinical efficacy of a new air polishing powder with glycine and 6 % tri-calcium phosphate in reducing dentin hypersensitivity (test) to a polishing powder with glycine alone (Clinpro Prophecy powder) as negative control.

**Methods** Prior to the study the clinical protocol was reviewed and accepted by the ethics committee of the medical faculty of Ludwig-Maximilians-University Munich. In a split-mouth-design the two powders were applied during a professional tooth cleaning on two non-adjacent teeth located in different sextants. Both teeth had a baseline air blast dentin hypersensitivity score of  $\geq 4$  on the numeral rating scale (NRS). Subjects were assessed using air blast stimulus with the NRS at baseline, after air polishing, after 10 days and after 4 weeks, 3 and 6 months.

**Results** A total of 38 out of 41 subjects completed the study. At baseline no significant differences in air blast score between test and negative control groups were evident. In the test group the air blast score of dentin hypersensitivity decreased significantly ( $P < 0.05$ ) after tooth cleaning compared to the control group (27 % vs. 14 %). 73 % of the teeth treated with test powder and 44 % of the teeth treated with control powder showed reduced air blast hypersensitivity ( $P < 0.05$ ). At 10 days, 4 weeks, 3 and 6 months the dentin hypersensitivity was still decreased (test: 22 %, 28 %, 35 %, 31 %; control: 13 %, 20 %, 29 %, 23 %) but the differences were no longer significant between test and control.

**Conclusions** The air polishing powder with glycine and tri-calcium phosphate provided significant reductions in hypersensitivity compared to baseline after a single application. Therefore air polishing with glycine and tri-calcium phosphate is suitable for professional tooth cleaning also for patients with dentin hypersensitivity. The tooth cleaning procedure revealed no adverse events.



0512

**Professional tooth cleaning: Cleaning efficacy of a novel air polishing powder**

Rauch, B., Häberlein, I., Schmid, B., Safi, A.

3M ESPE Dental

**Objectives** Patients complain that the water-powder-air-stream of air-polishing is unpleasant at teeth with hypersensitivity pain sensation. For that purpose Clinpro™ Glycine Propyl Powder with TCP was developed to allow professional tooth cleaning with immediate hypersensitivity pain relief by occlusion of dentinal tubules. The objective was to evaluate the cleaning performance of Clinpro™ Glycine Propyl Powder with TCP, a new glycine-based air-polishing-powder which contains fumaric acid coated tricalciumphosphate (<10%), on stained bovine enamel surface in comparison to other commercialized air-polishing-powders.

**Methods** Clinpro™ Glycine Propyl Powder with TCP, 3M ESPE, Clinpro™ Propyl Powder (glycine based powder), 3M ESPE; Air-Flow® Classic (bicarbonate based powder), EMS, and Flash Pearls, carbonate based powder (NSK) were applied with an Air-Flow® Handy 2 (EMS) air-polishing-device. The color of stained bovine enamel was measured with LAB-Scan device Color i7-benchtop spectrophotometer (X-Rite) before and after 5 sec air polishing treatment (treatment angle 60°; distance 4.3mm). Three stained bovine samples were treated per air-polishing powder and the color change ( $\Delta E^*_{ab}$ ) was measured twice at each specimen. The higher the  $\Delta E^*_{ab}$  value the higher the cleaning performance of the air-polishing powder.

**Results** The highest cleaning efficacy has been observed with the novel Clinpro™ Glycine Propyl Powder with TCP ( $\Delta E^*_{ab}=33.9\pm2.1$ ). The other air polishing powders showed  $\Delta E^*_{ab}$  values  $23.2\pm3.1$  (Clinpro™ Propyl Powder),  $23.1\pm1.5$  (Air-Flow Classic), and  $24.2\pm2.7$  (Flash Pearl). Statistical evaluation with One-way ANOVA revealed that Clinpro™ Glycine Propyl Powder with TCP has a significantly higher cleaning performance ( $p<0.05$ ) as all the other tested air-polishing powders which did not show statistically differences in cleaning efficacy in pair wise comparisons.

**Conclusions** Addition of fumaric-acid coated tricalciumphosphate to the glycine-based new air-polishing-powder increase cleaning performance significantly and is superior over the other air polishing powders tested under these *in vitro* conditions.

0513

**Colour Measurement Agreement Between Digital Assisted Devices And Conventional Methods**

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**Objectives** To make a clinical evaluation on the possibilities for colour measurement using digital and conventional methods.

**Methods** 216 clinical estimations of colour of the front upper and lower teeth are made, using: SpectroShade™ Micro (MHT Optic Research AG), VITA Easyshade Advance 4.0 (Vita) and a conventional shade guide Vita 3D-Master. The colour of each tooth is evaluated in three zones: cervical, medium and incisal. The results are collected in individual cards for colour measurement, prepared especially for the research. The indicators are analyzed separately by their lightness, chroma and hue using measure of agreement-kappa and nonparametrical analysis Wilcoxon Signed Ranks Test ( $p<0.05$ ).

**Results** The analysis of the data about the indicator-hue shows a relative coincidence when measured with SpectroShade™ and a conventional method ( $\kappa=0.292$ ) and when measured with Easyshade Advance and a conventional method ( $\kappa=0.377$ ). There is no coincidence in the data about hue, measured with SpectroShade™ and Easyshade Advance ( $\kappa=0.102$ ). The analysis of the data about lightness and chroma, measured with the two devices and a conventional method shows a coincidence and no statistically significant difference.

**Conclusions** The modern devices for colour measurement give the opportunity for fast, recreative and independent from exterior conditions way for assessment of colour. They reduce the subjective clinician's influence and the necessity for special light conditions.

0514

**Evaluation of factors influence the shade matching quality.**

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Yeditepe University Dental School

**Objectives** The purpose of this study is to evaluate the influence of color education, gender and level of experience on shade matching quality.

**Methods** The study is involved 200 dental and 18 postgraduate students, 130 female and 88 male. A lecture on color and color matching in dentistry was given to half of the dental students. Toothguide Training Box (TTB) which is working with Toothguide Trainer (TT) software, was used by all participants to perform all the steps of training procedure and lastly final test was done by the TTB. The test task was to successively match 15 shade guide tabs with the corresponding shade guides. The shade matching score for each participant, which was given by the TT software, was computed as a sum of color differences ( $\sum \Delta E$ ) between target tabs and selected tabs. Lower  $\Delta E$  scores and higher TT scores corresponded to better shade matching results and vice versa.

**Results** The results are evaluated in terms of experience and final exam results, the mean total scores of post-graduated students in prosthodontics were significantly higher and the mean of  $\sum \Delta E$  scores were significantly lower than 1. and 2. class of dental students ( $p < 0,01$ ). The mean total scores of the educated group was significantly higher and the mean  $\sum \Delta E$  scores of educated group was significantly lower than uneducated group ( $p < 0,01$ ). The number of corrects were significantly higher in educated group ( $p < 0,01$ ). The mean of total score and the mean of  $\sum \Delta E$ , there is no significant difference between genders.

**Conclusions** Training about color concept and also the guideline of Vita 3D-Master, provides more successful shade matching for dental professionals.

0515

**Color and translucency of composites related to the refractive indices of unfilled resins and filled polymer**

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**Objectives** To evaluate the effect of refractive indices (RIs) of unfilled resins and filled polymer on color and translucency of model composites.

**Methods** Resin mixtures were prepared using bisphenol-A-glycidyl methacrylate (BisGMA), urethane dimethacrylate (UDMA), a modified UDMA resin (FIT) and triethyleneglycol-dimethacrylate (TEGDMA) as BisGMA/TEGDMA, UDMA/TEGDMA and FIT/TEGDMA in 3:1, 2:1, 1:1, 1:2, 1:3 ratios. The RIs of unfilled resins were measured using an ABBE refractometer. Model composites, based on 2:1 and 1:1 resin mixtures, contained 70wt% of silanated Ba-glass fillers (0.7  $\mu\text{m}$  average size, RI=1.553) and 30wt% of resin matrix including 1wt% of photoinitiator. Samples, 20 mm in diameter and 2 mm thick, were polymerized using a LEDition light-curing light (Ivoclar Vivadent). Color was determined using an AvaSpec-2048 fiber-optic spectrometer (Avantes BV). Translucency was determined using the same spectrometer against a black and white background. The RIs of cured composites, i.e. filled polymer, were determined by the Becke-line method using a series of index matching oils. Data were analyzed using Pearson's correlation coefficient and regression analysis ( $\alpha=0.05$ ).

**Results** The RIs of unfilled resins were 1.4970-1.4745 (BisGMA/TEGDMA), 1.4765-1.4655 (UDMA/TEGDMA) and 1.4800-1.4675 (FIT/TEGDMA). The RIs decreased with increasing amounts of TEGDMA. Increased RIs of filled polymer, compared to unfilled resins, were found in all groups: 1.5262-1.5268 (UDMA-based composites), 1.5310-1.5314 (FIT-based composites) and 1.5396-1.5442 (BisGMA-based composites). BisGMA-based composites were more translucent and showed significantly lower  $L^*$  values than FIT- and UDMA-based composites. Positive correlation was found between the RIs of unfilled resins and filled polymer ( $p=0.001$ ), as well as between the RIs and translucency and color ( $p=0.001$  and  $p=0.008$ , respectively).

**Conclusions** Higher RIs of unfilled BisGMA/TEGDMA resins and filled polymer i.e. BisGMA-based composite were associated with higher translucency and greater deviation from 'ideal white' of BisGMA-based composite compared to UDMA- and FIT-based materials.

0516

**Effect of enamel shade thickness and dentin shade base on optical properties of a BisGMA-based composite**  
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**Objectives** To evaluate the effect of enamel shade thickness on color parameters and translucency of a commercial microhybrid BisGMA-based composite.

**Methods** Composite LC MH Ceramic AP (S&C Polymer GmbH, Germany) was used to prepare rectangular-shaped specimens of the following thickness: 0.2 mm (dentin A2 shade), 0.6 mm, 1 mm and 2 mm (enamel A2 shade). A high-intensity Bluephase polywave (Ivoclar Vivadent) light-curing unit was used to cure each sample for 40 s at 1 mm distance. Color and translucency (TP) of uncured and cured dentin (D) and enamel (E) specimens and cured combinations D2+E0.6, D2+E1 and D2+E2 were measured using a spectrophotometer VITA Easyshade Advance 4.0 (Vita) under the standard illuminant D65 against a white and black background. Three specimens were prepared in each group. Color values were expressed using the CIEL\*a\*b\* system. Data were analyzed using one-way ANOVA with Tukey's post-hoc test at  $\alpha=0.05$ .

**Results** TP values of uncured E specimens were  $16.56 \pm 0.13$ ,  $6.29 \pm 0.36$  and  $2.93 \pm 0.05$  (E0.6, E1, E2, respectively) and significantly increased to  $25.15 \pm 1.58$ ,  $18.08 \pm 0.28$  and  $8.57 \pm 1.91$  (E0.6, E1, E2, respectively) after polymerization ( $p < 0.05$ ). No differences in TP were observed between D+E groups ( $p > 0.05$ ). Color differences between uncured E specimens were not significantly different ( $p > 0.05$ ). Cured E specimens became significantly "whiter" ( $p < 0.05$ ) which was confirmed by the greatest  $\Delta b^*$  between uncured and cured groups. After polymerization, color differences between E groups exceeded the acceptability threshold ( $\Delta E \geq 3.3$ ), while those between D+E groups were clinically acceptable ( $\Delta E \leq 3.3$ ).

**Conclusions** Translucency decreased with increasing thickness of the enamel shade layer. Although the thickness of the enamel shade layer did not affect color parameters before curing, it significantly affected color changes after curing. Curing mostly affected  $b^*$ , followed by  $L^*$  whereas  $a^*$  was the least affected color parameter. In general, dentin shade base stabilized color and translucency of the enamel shade layer.

0518

**Long-term Color and Translucency Stability of Resin Composites with Different Surface Roughness**

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**Objectives** To evaluate the effect of long-term distilled water storage on the color and translucency parameter of composites with different surface roughness.

**Methods** Thirty disc-shaped specimens (10x2mm) for each resin composites shades A2 were prepared (Tetric N-Ceram, Filtek Z250, GC Gradia Direct Posterior) and submitted to surface treatments with SiC 1000 papers, Enhance Finishing System (Dentsply) and Sof-Lex aluminum oxide discs (3M/ESPE). Average surface roughness ( $R_a$ ) was measured with a profilometer. Color and translucency were recorded using a colorimeter after 24-hour storage and after 36-months storage in distilled water (37°C). Three way ANOVA and Paired t test were employed for statistical analysis.

**Results** The data showed statistically significant interaction between surface roughness and materials on color change ( $\Delta E$ ); but only the materials have an effect on translucency parameter (TP) ( $p < 0.001$ ). Tetric N-Ceram showed the smallest aging-dependent color shift followed by Filtek Z250 and GC Gradia Direct Posterior. GC Gradia direct showed the smallest aging-dependent translucency shift followed by Filtek Z250 and Tetric N-Ceram.

**Conclusions** Effect of aging on color of resin composites were surface roughness and composite dependent. Translucency was not affected by surface roughness among the water storage.

**Effect of finishing, polishing and staining on esthetic properties of resin-based composites**Komlenic, V. N.<sup>1</sup>, Marjanovic, J.<sup>1</sup>, Trifkovic, B.<sup>2</sup>, Miletic, V.<sup>1</sup><sup>1</sup>University of Belgrade, <sup>2</sup>University of Belgrade

**Objectives** To examine the effect of polishing and artificial staining on gloss, color and translucency of resin-based composites.

**Methods** Micro-hybrid composites LC MH Ceramic AP (A1 shade; S&C Polymer GmbH; marketed in Serbia as Festy, Galenika), Te-Econom (A1 shade; Ivoclar Vivadent) and Gradia (XBW shade; GC) were used to prepare 30 rectangular-shaped specimens of each composite in a silicon mold placed between two glass slides. Specimens were cured for 40 s unilaterally (LEdition; Ivoclar Vivadent) and allocated to 5 groups (n=6):

Group 1: Diamond bur+composite rubber polisher (NTI);

Group 2: Diamond bur+composite rubber polisher+Vantol paste (Galenika);

Group 3: SuperSnap set (Schofu);

Group 4: SuperSnap+SuperBuff set (Schofu);

Group 5: Control-unpolished

Following polishing, each group was divided into two sub-groups of 3 specimens each depending on the colored solution. The specimens were kept in Nescafe or red wine for 7 days at 37°C. Gloss was measured using a gloss checker (IG-331; Horiba) and color parameters were determined using a spectrophotometer VITA Easy Shade Advance 4.0 (Vita). Data were statistically analyzed using a general linear model (GLM) and analysis of variance with Tukey's post-hoc test at  $\alpha=0.05$ .

**Results** Statistically significant differences in gloss between composites (Festy>Te-Econom> Gradia) and polishing techniques (Group 5>Group 4>Group 3>Group 1>Group 2) were recorded. Gradia showed no differences in gloss before and after staining irrespective of the solution ( $p>0.05$ ) whereas Festy and Te-Econom generally showed higher gloss after staining in red wine ( $p<0.05$ ). Translucency decreased after staining:  $\Delta P=-4.03$  (Gradia),  $\Delta P=-3.45$  (Te-Econom),  $\Delta P=-1.07$  (Festy). Color changes were significant in all groups after staining:  $\Delta E=30.9$  (Te-Econom),  $\Delta E=30.2$  (Gradia),  $\Delta E=24.9$  (Festy).

**Conclusions** SuperSnap and SuperBuff set provided the highest gloss. Though less glossy than Festy and Te-Econom, Gradia showed the most stable gloss after staining. Staining largely affected color and to a much lesser extent the translucency of all tested composites.

0520

**Polishing systems and beverages' effects on color-stability of resins**

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**Objectives** To evaluate effect of different polishing systems and two staining beverages on color stability of restorative resins after different immersion times.

**Methods** Three restorative resins; a nano-hybrid composite, Tetric EvoCeram Bulk Fill(TB); a nano-ceramic composite, Ceram-X Mono(CXM), and a low shrink posterior restorative, Filtek Silorane(FS) were used for the study. Forty-eight disc-shaped specimens of each restorative were prepared under Mylar strip polymerization and randomly divided into two groups according to different polishing systems; PoGo(PG) and SuperSnap(SS). The baseline color values ( $L^*, a^*, b^*$ ) of each specimen were measured with a spectrophotometer according to the CIELab system. Each group was then subdivided randomly into three sub-groups( $n=8$ ), which were immersed in different staining beverages (green tea, green coffee and distilled water). After 1, 7 and 15 days of immersion, the color values of each specimen were remeasured and the color change value( $\Delta E^*_{ab}$ ) was calculated. Data were statistically analyzed by 3-way ANOVA( $p<0.05$ ).

**Results** Unacceptable color change was found in all restoratives immersed in coffee or tea regardless of immersion time. Distilled water seemed to produce significant discoloration, but it was within the acceptable range( $\Delta E<3.3$ ). No differences were found between TB and S immersed in tea regardless of the polishing systems( $p>0.05$ ). There were no differences among the restorative materials immersed in coffee, polished with PG whereas no differences were found between TB and CXM polished with SS( $p>0.05$ ). Significant differences were found between polishing systems in Silorane and CXM samples'  $\Delta E$  values regardless of immersion solution and time( $p<0.05$ ). For Tetric, while no differences were noted between polishing systems in coffee immersed samples, significant difference were observed in tea immersed ones. No differences were found between polishing systems for all samples immersed in water( $p>0.05$ ).

**Conclusions** The effect of staining solutions (green tea/green coffee) and polishing systems on color changes might be resin material dependent.

0521

**The effect of the shade of the abutment tooth and resin cement on CAD-CAM laminate systems with different translucency and thickness.**

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**Objectives** The purpose of this study was to evaluate the effect of the shade of the abutment tooth, resin cement shade on the resultant optical properties of porcelain laminate veneers (PLVs) fabricated from CAD/CAM ceramics with different translucency and thickness.

**Methods** Fifty six ceramic plates were obtained from leucite-reinforced glass-ceramic (IPS Empress CAD) and lithium disilicate ceramic (IPS E.max CAD) blocks in different thickness (0.5-mm and 1.0-mm thickness) using a diamond saw under water cooling. Ceramic plates were in two different shades, as follows: HT (high translucent-A2) and LT (low translucent-A2). To simulate the normal coloured and discoloured underlying structure as the abutment tooth, 8 resin rectangular specimens (Triad VLC) were prepared from shade Ivory Light and Dark (12-mm diameter; 4-mm thickness) in two groups. Four different shades (Yellow, White, Bleach, Transparent, Variolink Veneer) of resin cement were applied onto each of these abutment tooth. Colour measurements were performed using Vita Easyshade spectrophotometer and records were used to calculate the  $\Delta E$  values.

**Results**  $\Delta E$  values were influenced by ceramic shade and thickness, abutment tooth shade and resin cement shade. The highest colour difference was obtained from the 0.5-mm-thickness HT shade IPS E-Max CAD ceramic with the Bleach shade cement on abutment tooth (Ivory Light), whereas the 1 mm-thickness LT shade E-Max CAD ceramic with the Bleach shade cement on abutment tooth (Ivory Dark) exhibited the lowest. There was no significant difference between the ceramics ( $p>0.05$ ). The 0.5-mm-thickness ceramics exhibited higher  $\Delta E$  values than 1-mm thickness ceramics. The abutment tooth (Ivory Light), showed higher  $\Delta E$  values than did abutment tooth (Ivory Dark). The HT ceramic shade caused higher  $\Delta E$  values compared with LT ceramic shade.

**Conclusions** Using the Bleach shade resin cement with 1 mm thickness LT shade PLV ceramics seems to be more effective in masking the discoloured tooth.

0522

### **The Effect of Different pH Levels of Artificial Saliva On The Color Stability of Self-Adhesive Resin Cements**

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**Objectives** To evaluate the effect of different pH levels of artificial saliva on the color stability of self-adhesive resin cements.

**Methods** 30 disc-shaped cylinders in same shade (8mm diameter, 1mm height) were fabricated for each resin cements. (RelyX U200, G-Cem, Smart Cem 2). Specimens of each resin cement group were divided into 3 subgroups (n=10) and stored into 3 different pH levels (pH3.5, pH7, pH10) of artificial saliva for 10 days at 37°C. The color values of all groups were measured before and after exposure to artificial saliva with a spectrophotometer (Vita easys shade). Data were recorded according to the CIE L\*a\*b\* system and then color changes ( $\Delta E^*$ ) were calculated. Mean values were statistically analyzed using Kruskal Wallis test.

**Results** There was no statistical significant difference between G-Cem and Smart Cem 2 for pH 3.5 level. In RelyX U200 for pH 3.5 and pH 7 levels, there were statistically significant differences ( $p < 0.005$ ). In RelyX U200 for pH 3.5 and pH 10 levels, there were statistically significant differences. In RelyX U200 for pH 7 and pH 10 levels, there were no statistically significant differences ( $p > 0.005$ ). For all pH levels, there were statistically significant differences. For pH 3.5 and 10 levels, there were statistically significant differences between RelyX U200 and G-Cem. Also there were statistically significant differences between Smart Cem 2 and G-Cem. There were no statistically significant differences between RelyX U200 and Smart Cem 2. For pH 7 levels, there were statistically significant differences between all groups. G-Cem had the lowest  $\Delta E^*$  between all groups for all pH levels. In G-Cem and Smart Cem 2, pH changes had no effects on the color stability.

**Conclusions** G-Cem resin cement, which had the better color stability in different pH levels, was recommended to use in adhesive cementation.

0523

### **Effect Of Bleaching Agent On Physical And Aesthetic Properties Of Restorative Materials**

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**Objectives** To investigate the effect of bleaching agent on microhardness, color and light transmission of different restorative materials.

**Methods** Specimens (n=20) of Tetric EvoCeram (TEC), Tetric EvoCeram Bulk Fill (TECBF) (Ivoclar Vivadent) and Equia (EQUIA) (GC) were randomly subdivided in two groups (n=10). Specimens were treated with Opalescence Boost (Ultradent) during 45 minutes or distilled water. Specimens were immersed in tea solution for 7 and 14 days. Color, microhardness and light transmission were monitored at baseline, after bleaching and after immersion. Microhardness was measured using Vickers tester. Color was measured using VITA Easyshade. Light transmission was measured using Ocean Optics spectrometer.

**Results** Microhardness measurements showed statistically significant difference after bleaching, which was on average the highest TECBF ( $p < 0.001$ ) and of equal intensity when EQUIA and TEC ( $p < 0.001$ ) were used. No significant difference in color change was observed in TECBF and TEC which was not clinically visible ( $\Delta E < 2$ ). EQUIA resulted in statistically significant difference after immersion in tea for 7 and 14 days ( $\Delta E > 3$ ). The smallest light transmission was measured for TEC kept in tea solution for 7 days. EQUIA samples which were kept in tea solution for 7 and 14 days showed the weakest light transmission, and those values were noticeably greater (they differ from each other by 50%) in regard to TEC and TECBF.

**Conclusions** Bleaching can affect the change in microhardness, color and light transmission of restorative materials and such filling should be sometimes replaced.

This study was supported by Croatian Science Foundation.

0524

#### **Effectiveness of a New Bleaching Agent After Single Use Treatment**

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**Objectives** This in-vivo study was aimed to examine whitening effects for frontal teeth of the upper and lower jaw using an OTC non-hydrogen peroxide bleaching agent (BA) in comparison to a placebo (P) after single-use. **Methods** Forty subjects (25♀15♂) participated in this double-blind randomized controlled trial. The subjects were randomly allocated into two groups (n=20). Group (BA) received the OTC product iWhite Instant with Pthalimido-Peroxy-Capronacid and group (P) the placebo with identical application and composition except for the active agents. Before initiation of the study the kappa-coefficient-value for intra-examiner-reliability was determined (0.83).

Each subject was treated with a pre-filled application tray containing iWhite Instant or the placebo. The tooth shade of the teeth 13-23 and 33-43 was assessed before treatment (E0), immediately after (E1) and 24h after (E2) treatment. The tooth shades were recorded with a value-oriented shade guide (Vita classical) using a light (1) to dark (16) scale. Statistical testing was accomplished using Mann-Whitney-U-Test ( $p < 0.001$ ).

**Results** The dropout rate was 0%. There were no significant differences at the baseline measurements (E0) between P and BA regarding the assessed tooth color. Differences in tooth color changes immediately after single use ( $\Delta E0\_E1$ ) and 24h after ( $\Delta E0\_E2$ ) the treatment were calculated for both groups. The means (standard deviations) of tooth color changes (overall color changes) regarding  $\Delta E0\_E1$  were 2.26 (0.92) for BA and 0.01 (0.21) for P. Overall color changes for  $\Delta E0\_E2$  showed means (standard deviations) of 2.15 (1.10) for BA and 0.07 (0.35) for P. For  $\Delta E0\_E1$  and  $\Delta E0\_E2$  significant differences were found between the use of iWhite Instant and the placebo.

**Conclusions** Within the limitations of this study, the results showed that a non-hydrogen peroxide bleaching agent has whitening effects immediately and 24h after single-use treatment.

0525

#### **Mechanical Testing Performance of Reinforced Encapsulated Glass Ionomer Cements**

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**Objectives** To evaluate the effect of resin coating on compressive strength of encapsulated glass ionomer cements. **Methods** A resin coating (EQUIA Coat, GC Europe, Leuven, Belgium) and a varnish (GC Varnish, GC Europe) were used for covering upper surfaces of samples. Three control groups [composite-resin, CR (Gradia Direct Posterior, GC Europe), non-coated EQUIA Fil, EF (EQUIA Fil, GC Europe), non-coated Riva Self Cure, RS (Riva Self Cure, SDI, Bayswater, VIC, Australia)], two resin-coated groups [resin-coated EQUIA Fil (CEF), resin-coated Riva Self Cure (CRS)] and two varnished groups [varnished EQUIA Fil (VEF), varnished Riva Self Cure (VRS)] used. Seven groups (n=10) were tested in three different time cycles (24hours, 7days, 30days). 4mm diameter and 6mm height of samples were prepared at 23°C in cylindrical shaped metal moulds according to instructions of manufacturer and stored in artificial saliva (SAGF Medium) at 37°C. A colorant pigment (0.01% Rhodamine B isothiocyanate, Merck, Darmstadt, Germany) added into resin coating and varnish for easy observation. A halogen light (Elipar Triligh, 3M ESPE, ESPE Platz, Seefeld, Bavaria) used for polymerization of resin coating for 20 seconds. Ultrasonic cleaning (Elmasonic S, Elma Ultrasonic, Singen, Germany) was applied for 10 minutes before testing. The dimensional evaluation of samples were applied with a digital calliper (Super Solar Calliper, Mitutoyo, Michigan, USA) and the datas were computerized. Compressive strength tests were performed with on a universal test device (Zwick/Roell GmbH & Co. KG, Ulm, Germany) at a crosshead speed of 1 mm/min. One-way Anova, Tukey HSD test and T-test were used for statistical analysis at .05 significant degree.

**Results** CR groups were evaluated highest values for each test periods ( $p < 0.05$ ). Non-coated glass ionomer cement groups were showed significantly higher results than coated and varnished groups and were reached highest values at the end of 30 days ( $p < 0.05$ ). Resin-coated groups were quantified similar compressive strength values for all test periods.

**Conclusions** It was determined that resin coating application caused no increase on compressive strength of encapsulated glass ionomer cements.

0526

#### Evaluation of Two Experimental GICs with New Apatite Formulations

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**Objectives** To examine the effect of heat, coating, storage agents and ageing on the mechanical behavior of two experimental glass-ionomer cements (GICs).

**Methods** One commercially available GIC (Fuji9) and two experimental GICs (F9ap-sphere, F9ap-CFap) were used. The specimens were prepared with three different conditions; (1) Without coating, (2) 20s heat application with LED (Translux Power Blue/Heraeus Kulzer) with coating, (3) 20s heat application with LED without coating and stored in distilled water or artificial saliva at 37°C for one week and one month. Flexural Strength (FS) was evaluated using a three-point bending test on bar-shaped specimens (16×2×2mm) (n=10). Fragments of the three-point bending test were used to determine Vickers Hardness (VH) with a microhardness tester. Water sorption (Ws) was calculated as the difference between the dry mass of the GIC specimens before water sorption and after each immersion time using the three-point bending test specimens. Results were compared with one-way ANOVA and Tukey's HSD post-hoc test ( $\alpha=0.005$ ). A multivariate analysis (general linear model) assessed the effect's strength of the parameters GIC, coating, storage agent and storage duration on the considered properties.

**Results** Post-hoc multiple comparisons revealed significant differences among the VH of all tested materials, Fuji9>F9ap-sphere>F9ap-CFap ( $p<0.001$ ). The materials prepared according to manufacturer's recommendation had higher VH ( $p<0.001$ ). Application of heat, neither by means of coating nor without coating improved the VH ( $p>0.05$ ). Storing in artificial saliva ( $\eta^2=0.100$ ) and increasing storage duration ( $\eta^2=0.317$ ) decreased the VH. Fuji9 showed lower FS than either F9ap-sphere or F9ap-CFap under all conditions ( $p=0.007$ ). Preparation methods or ageing did not affect the FS ( $p>0.05$ ). All materials showed similar water sorption levels for all testing conditions ( $p>0.05$ ).

**Conclusions** The experimental GICs might represent a promising approach due to their flexural strength, microhardness and water sorption characteristics but Fuji9 showed better mechanical properties than the tested two experimental GICs.

0527

#### Effect of Acidic Beverages on The Surface Roughness of Glass Ionomers and Glass Carbomer

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**Objectives** The aim of this in vitro study was to evaluate the effect of acidic beverages (Coke, orange juice and the mixture of orange-pomegranate juice) on surface roughness of glass ionomers and glass carbomer restorative materials.

**Methods** In this study four different materials were used: Nanohybrid composite (Z550, 3M-ESPE), resin-modified glass ionomer (Photac-Fil Quick Aplicap, 3M-ESPE), glass ionomer cement (GlasIonomer Type-II, Shofu) and glass carbomer (GCP Glass-Fill, GCP Dental). Discs (n:28, 5x2mm) from each restorative material were prepared according to manufacturers' instructions. The surfaces of specimens were polished with aluminum-oxide discs and then stored in artificial saliva for 48 hours. The initial roughness measurements of the specimens were obtained from the surfaces and then, they were randomly divided into 4 groups for different acidic beverage applications (n:7). In *Group1*: specimens were kept in artificial saliva. In *Group2*: coke (Coca-Cola, Coca-Cola Co.) with pH 2.3, in *Group3*: orange juice (%100 Orange Juice, Dimes Ltd, Turkey) with pH 3.9 and in *Group4*: the mixture of orange-pomegranate juice (%100 Pomegranate Juice, Dimes Ltd, Turkey) with pH 3.4 was applied to the specimens.

The samples were immersed into beverages for total 12 hours (3 days, 4 hours per-day). After immersion, surface roughness measurements were obtained from the same surfaces of the specimens at 5 different locations by a stylus-type surface profilometer. The percentage of differences of each specimen between the initial roughnesses and the values after applications were evaluated with two-way ANOVA and posthoc Bonferroni multiple comparisons tests ( $p<0.05$ ).

**Results** In *Group1* glass carbomer demonstrated greater roughness change than RMGI and GIC ( $p<0.05$ ). In coke and orange juice groups glass carbomer had the greatest difference in roughness than the other materials ( $p<0.05$ ).

**Conclusions** All glass ionomers and glass carbomer were affected by different acidic beverages. In addition, glass carbomer significantly showed the most percentage differences in surface roughness.



0528

**Fluoride releasing and recharging of glass-ionomer in contemporary restorative-material**

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**Objectives** The object of this study was to investigate a potential of fluoride releasing and recharging in representative restorative materials. Null hypothesis was that fluoride releasing and recharging potential of every kind of material was not different.

**Methods** Three contemporary restorative materials (Fuji IX<sub>GP</sub> capsule: GC Corp., Beautifil II: SHOFU Inc., CLEARFIL AP-X: Kuraray Noritake Dental Inc.) were used. To create coin shape specimen, pastes of respective materials were into a mold (12mm in diameter, 1mm in height), waited until cure (Fuji IX<sub>GP</sub>) or light-cured (Beautifil II, CLEARFIL AP-X), and were stored in 37°C chamber for 1day. Then specimens were soaked into solution (pH4.0, 5.0ml) which was adjusted with lactic acid, and the solution was daily renewed. After 7days, specimens were dipped in NaF solution (9,000ppmF, 1.0ml, 5min), and were washed (1min) in much distilled water. And then, specimens were soaked into the solution again and the lactate solution was also renewed daily. Finally, 14 "daily" solutions were acquired for one coin specimen. 6 coin specimens were prepared for each material. Therefore, 252 stocks of solution were acquired.

Concentration of F<sup>-</sup> (ppm) in all solution was measured (Fluoride-ion Selective Electrode, TISAB II).

Concentration of F<sup>-</sup> of day-1, -4, -7, -8, -11 and -14 were statistically analyzed (Games-Howell test).

**Results** In Fuji IX<sub>GP</sub>, day-8(9.7ppmF) showed statistically higher concentration than day-7(4.3ppmF). In Beautifil II, day-8(3.8ppmF) showed statistically higher concentration than day-7(1.5ppmF). In CLEARFIL AP-X, day-8(0ppmF) did not recharge fluoride ion.

**Conclusions** In glass-ionomer cement (Fuji IX<sub>GP</sub>) and resin composite containing with glass-ionomer filler (Beautifil II), step of soaking in 9,000ppmF solution was effective for F<sup>-</sup> recharging.

0529

**Clinical Evaluation of Glass-Ionomer versus Bulk-Fill Resin-Composite in Children**

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**Objectives** Glass-ionomer based restorative system (GIC) is commonly indicated for posterior restorations due to the increase in demand for filling the cavity in bulk without polymerization devices. Bulk-fill resin composites (BRC) are proposed as alternatives to GIC that do not require incremental filling. This clinical study evaluated the clinical performance of these two types of materials.

**Methods** Between May-2014 and April-2015, a total of 35 patients (10-12 years of age), who had matched pair of mandibular carious molars with Class I or Class II cavities were enrolled in the study. Each patient received two restorations randomly either with a GIC (EQUIA, GC) with a self-adhesive nanofilled coating (Equia Coat, GC) or BRC (Tetric EvoCeram, Ivoclar Vivadent) after using a self-etch adhesive (AdheSe OneF, Ivoclar Vivadent). Two independent examiners evaluated the restorations at baseline and at 6, 12 months (modified US Public Health Service criteria).

**Results** Mean observation period was 10.4 months. Depth of cavities ranged between 2.5 to 6 mm with a mean of 3.7 mm. While 2 chippings were observed with GIC, no failures were observed for BRCs. GIC restorations with chippings were repaired. Secondary caries did not occur in any of the teeth. Marginal discoloration criteria were similar in both materials (1 GIC, 1 BRC) but marginal deterioration (4 GIC, 2 BRC), anatomical form change (3 GIC, 0 BRC), and surface porosity (2 GIC, 0 BRC) were more common with the GIC.

**Conclusions** Both glass-ionomer cement and bulk-fill resin composite performed similar up to 18 months in permanent molars in Class I and II cavities in terms of retention, providing that two chipping incidences were observed with the GIC with more common surface degradation.

0530

### **Clinical Evaluation of a Compomer and a Glass Ionomer Cement : 1-Year Follow-Up**

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University of EGE

**Objectives** The aim of this study was to compare clinically a high viscosity glass ionomer cement (GIC) with a compomer at one year.

**Methods** Fourty patients (mean age:  $6,8 \pm 1,08$ ) who referred to Ege University School of Dentistry with at least four carious primary molars participated the study. The test materials were placed as; Group I: Fuji IX GP Extra+ Fuji G-Coat Plus, Group II: Fuji IX GP Extra+ Fuji Varnish, Group III: Dyract Extra+ Fuji G-Coat Plus and Group IV: Dyract Extra. Totally 40 Class I and 168 Class II cavities were restored at baseline and at one-year examination 205 restorations were evaluated and 3 teeth were lost. Two calibrated observers evaluated the restorations using modified Ryge criteria. Pearson Chi Square, Kaplan Meier and long rank tests were used to analyze the survival rates.

**Results** There were no failures in Class I cavities of all groups. The survival rates of Class II restorations were 87.6% for Group I, 89.8% for Group II, 97.9% for Group III, 94% for Group IV. However there was no statistically significant difference among the groups after the observation period of one year. In addition the scores of modified Ryge criteria were found similar between the groups.

**Conclusions** It could be concluded that high viscosity GIC may be an alternative restorative material to compomers in the restoration of primary molars in children. However, no additional effects of varnish or coat with these materials could be demonstrated.

0531

### **The clinical performance of resin modified and high viscosity glass ionomer cements without conditioning the dentine**

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Ege University School Of Dentistry

**Objectives** The resin modified glass ionomer (RMGIC) and glass ionomer cements (GIC) are able to bond to the smear layer due to polyacrylic acid content, which acts as a mild self-conditioner. Furthermore, the inherent dentin irregularities produce during cavity preparation provides micromechanical retention. The aim of the present study was to compare one year clinical performance of a capsulated resin modified glass ionomer cement and a capsulated high viscosity GIC without using a cavity conditioner, leaving the smear layer intact.

**Methods** A total of 44 children aged between 6-8 years old who had bilateral matched pairs of approximal carious on mandibular primary molar teeth were included. A total of 88 restorations were placed by using a capsulated RMGIC (Photac Fil) and a capsulated high viscosity GIC (Ketac Molar). The restorations were evaluated after 6 and 12-month intervals using USPHS-Ryge criteria. The results were analyzed statistically using Kaplan-Meier and Log-rank tests.

**Results** The 12 month cumulative survival rate for two restorative materials were 94.1 % and 64.7 % for the resin modified glass ionomer cement and high viscosity GIC, respectively. The examiners evaluated 41 children after 12 months of follow-up; dropout rate was 6.8 percent. There was a statistically significant difference in the clinical performance of the two materials.

**Conclusions** The resin modified glass ionomer cement performed better than the high viscosity GIC even after without the usage of cavity conditioner.

0532

### **Linear Dimensional Change in Polyether Impression Materials**

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3M ESPE

**Objectives** The linear dimensional change of two commercial and two newly introduced polyether monophase impression materials after 24 h and after 14 days was analyzed at three different storage conditions.

**Methods** For this study two established (ImpregumPentaSoft Medium-Body; B#517272; C#516617,IPS; and ImpregumPenta Medium-Body; B#434951; C#435694,IMP) and two newly introduced polyether impression materials (SoftMonophase; B#496372; C#496013; Monophase, B#496356, C#496013) were used. Two materials with a final shore A hardness in the range of 60 and two soft material with a final shore hardness in the range of 50 were compared with each other. 3 specimen of each material were prepared according to ISO 4823:2000 and stored up to 14 days at 3 different storage conditions with varying humidity of  $2\pm 1\%$  rH,  $50\pm 10\%$  rH and  $98\pm 1\%$  rH. The linear dimensional change of each specimen was evaluated twice using two different spots (n=6).

**Results** Results and standard deviations obtained by one-way-Anova and Tukey Test ( $p < 0.05$ ) are shown below. Additionally, all materials fulfilled the ISO criterion for gypsum compatibility after 14 days.

Table with results uploaded as picture.

Means that do not share a letter are significantly different

**Conclusions** All materials fulfilled the requirement of ISO4823:2000 for the Linear Dimensional Change (max.1.5%) at 24 h and even after 14 days at standard conditions (50%rH) and also at extreme dry and wet conditions. There was no statistically significant difference between the two soft materials with the lower shore hardness and the two materials with a higher hardness?

Based on this study it can be concluded that delayed pouring of polyether impressions after up to 14 days will not negatively affect the detail accuracy of the received models.

3M ESPE recommends pouring polyether impressions within 14 days after taking the impression.

0533

### **COMPARISON OF SURFACE DETAIL REPRODUCTION OF OCULAR IMPRESSION MATERIALS**

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**Objectives** To evaluate the surface detail reproduction of four types of ocular socket compatible impression materials.

**Methods** Three alginate impression materials (Ca37 (C), Ophthalmic Alginate (OA), Orthoprint(A)) and one polyvinyl siloxane material (Affinis(P)) have been tested. A total of 40 impressions were made of stainless steel metal dies (ADA specification 19). The dies had 2 vertical and 3 horizontal lines inscribed on their superior surfaces. The measurements have been conducted on the 20-50-75  $\mu$ m horizontal lines on the surface of the impression. Surface detail reproduction was evaluated using a microscope at 80X magnification. Statistical analysis was performed (one-way ANOVA and Bonferroni,  $\alpha=0.05$ ).

**Results** Polyvinyl siloxane material resulted in the highest values at all of the 20-50-75  $\mu$ m lines ( $23,47\pm 2,98$ ,  $24,71\pm 2,12$ ,  $41,00\pm 4,20$ , respectively); whereas, lowest values were observed with A ( $7,31\pm 1,51$ ,  $11,85\pm 2,93$ ,  $30,99\pm 4,38$ , respectively).

**Conclusions** Polyvinyl siloxane impression material exhibited the highest surface detail necessary for the construction of an ocular prosthesis among other impression materials tested.

0534

### **Evaluation of Accuracy of Impression Techniques and Materials in Implants**

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**Objectives** The aim of this study was to investigate the accuracy of different flowable A-silicone impression materials and techniques in models simulating implants

**Methods** 7 master models simulating a tooth with a implant (Implant Ka, Turkey) at the site of missing tooth no:26 were fabricated. Seven different flowable impression materials (Heraeus- Kulzer, Germany) and techniques [intraoral digital (1), putty + light (2), heavy + light (3), Monophase (4), Medium (5), Medium + Extralight (6), wash technique (7)] were used for each master model. A total of (10x7=) 70 impressions were made. Casts were scanned by an optical 3D Scanner and data were transferred to VRMesh software. Master model and duplicate cast scans were digitally aligned observing the superposition of anatomic markers. After **impression, models were** calculated and data were statistically analyzed

**Results** Statistical analysis revealed that impressions were affected by both consistency of the impression material and application technique ( $p < 0.05$ ). According to statistical analyses, the accuracy of impression materials and techniques were ranging as  $2 = 3 > 4 = 7 > 1 > 6 = 5$  from most accurate to the least

**Conclusions** Impression technique and materials were found to be effective on the accuracy of implant impressions.

0535

### **Evaluation of Protocols for Repair of Enamel/Dentin-composite Complex**

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**Objectives** This study evaluated different sequence of conditioning scenarios representing cross-contamination for enamel/dentin-composite complex

**Methods** Maxillary central incisors (N=100, n=10) were collected, coronal parts of the teeth were embedded in PMMA. Cavities (diameter:2.6 mm, depth:2 mm) were opened in the middle of the labial surfaces and the specimens were randomly divided into 10 groups. Nanohybrid (Grandio, Voco) resin composite was photo-polymerized in the cavities. The composite-enamel surfaces were ground finished. For composite-dentin complex, initially dentin was exposed, cylindrical cavities were opened and filled as in enamel group. The surfaces of the substrate composites and the surrounding enamel/dentin were conditioned according to one of the conditioning protocols (P). P1:Silicacoating (SilJet sand) (composite)+silanization (composite)+acid-etching (enamel/dentin)+primer (dentin)+bonding agent (enamel/dentin+composite), P2:Acid-etching (enamel/dentin)+silica coating (composite)+silanization (composite)+primer (dentin)+bonding agent (enamel/dentin+composite), P3:Silicacoating (composite)+Acid-etching (enamel/dentin)+silanization (composite)+primer (dentin)+bonding agent (enamel/dentin+composite), P4:Acid-etching (enamel/dentin)+primer (dentin)+bonding agent (enamel/dentin), Silicacoating (composite)+silanization (composite)+bonding agent (composite). Enamel, dentin and composite repair alone acted as the control groups (n=10 per group). Primer, bonding agent were applied and repair resin was adhered to the substrates using polyethylene molds (diameter: 3.6 mm). After thermocycling (x500), shear force was applied to the adhesive interface (1 mm/min). Bond strength values (MPa) were statistically analyzed (Two-way ANOVA, Tukey's;  $\alpha=0.05$ ).

**Results** Significant effects of the conditioning protocol ( $p=0.006$ ) and the substrate type ( $p=0.000$ ) were found. Adhesion to enamel ( $32.8 \pm 8.5$  MPa), dentin ( $24.2 \pm 4.2$  MPa) and composite alone ( $25.1 \pm 5.2$  MPa) presented lower mean results ( $p < 0.05$ ) than other groups. Protocols 1 to 4 performed similar within enamel/dentin-composite complex ( $64.9 \pm 22.1 - 42.3 \pm 10$ ).

**Conclusions** In the repair of composites next to the dentin, conditioning the composite with silica-coating and silanization after etching the dentin adds to the repair strength than silane application only.

0536

**Effect of surface treatments and composite type on the bond strength of repaired composite resins**

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**Objectives** Objective: This study investigated the effects of three different surface treatments and two different adhesive systems on the micro-tensile bond strength ( $\mu$ TBS) of repaired composite resins using of the same or different kind.

**Methods** Materials and methods: Twenty four nanohybrid [Ceram X mono(C)-shade A4] and 24 nanofilled [Filtek Ultimate (F)-shade A4] composite discs were prepared (10 mm diameter, 4 mm height). The specimens were aged with 5,000 thermocycles and randomly divided into three groups, according to the following surface treatments: a) phosphoric acid gel b) Er:YAG laser c) aluminum trioxide particle (air abrasion) (n=8). Fresh composite discs (24 disc C-shade A1 and 24 disc F-shade A1) were bonded to the treated surfaces with two different bonding agents (two step and one step self-etch adhesive system) (n=4). Then, the specimens were aged with 5,000 thermocycles again. The stick shaped microtensile specimens from discs were prepared (n=25) and sticks were subjected to micro-tensile bond strength test. For each surface treatment method one dentine sample was analyzed using scanning electron microscopy.

**Results** Results: There were significant differences in  $\mu$ TBS value among surface treatment methods ( $p<0.05$ ), but there were no significant differences among adhesive systems ( $p>0.05$ ). When Ceram X mono used as a filling material and repaired the same kind of composite, the highest  $\mu$ TBS value was recorded with air abrasion&one step self-etch adhesive system ( $41.25 \pm 8.32$  MPa). When Ceram X mono used as a filling material and repaired the different kind of composite, the lowest value was observed with Er:YAG laser &two step self-etch adhesive system ( $24.27 \pm 5.94$  MPa).

**Conclusions** Conclusions: Surface treatments significantly affected the repair bond strength of composite resins. The treatment with air abrasion became more effective and may be suggested for repairing composite restorations.

0538

**Effect of different surface treatments on CAD/CAM Resin Nano Ceramics-resin composite repair bond strength**

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**Objectives** The aim of this study was to evaluate the influence of selected different surface treatment modalities (air abrasion, roughening with a bur ), intermediate agents (comprised of different adhesive systems) and the effect of phosphoric acid on the shear bond strength (SBS) of resin based composites to aged CAD/CAM resin nano-ceramics.

**Methods** Two hundred forty slices of aged resin nanoceramic (LAVA Ultimate ; 10,000 cycles, 5 and 55 °C) were embedded in acrylic resin. Their surfaces were finished with 2400-grit silicon carbide paper. The blocks were randomly assigned to three groups (n=80): Group C; Pretreated with Cojet ,Group D; roughened with coarse diamond bur Group N; No pretreatment. Immediately after pretreatment, half of the specimens of each group were cleaned with phosphoric acid , while the rest were only rinsed with water.

Each group were then divided into 4 subgroups of 10 specimens according to applied conditioning methods: B; Adhesive U; Universal S; Silane and adhesive, Q; Control with no intermediate agent. The repair composite Filtek Z250 were applied onto the bonding surfaces of the specimens. Thereafter, all specimens were stored in distilled water at 37°C for 24 h. A universal testing machine were used to test shear bond strength.

**Results** The influence of pretreatment and conditioning methods on SBS to resin nanoceramic were found statistically significant ( $p:0.001$ ;  $p<0.01$ ) while etching with phosphoric acid didn't increase the bond strength ( $p:0.841$ ;  $p>0.05$ ). The results were evaluated statistically with Shapiro Wilks, one-way, three-way ANOVA, Tamhane's T2 and student t test.

**Conclusions** Different combinations of pretreatment and conditioning methods affect repair bond strength differently. The highest shear bond strength values were achieved by grinding the surface with diamond bur whereas the lowest values were obtained with no pretreated group.

0540

**The 6-Months Randomized Clinical Evaluation Of A One-Step Multi-Mode Universal Adhesive In Non-Carious Cervical Lesions**

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**Objectives** The purpose of this double-blind randomized clinical trial was to compare the 6-months clinical performance of an one-step multi-mode universal adhesive (SBU-3M ESPE, Scotchbond Universal Adhesive, MN, USA) in combination with nanohybrid resin composite (RC-Z550, 3M ESPE, MN, USA) for restoration of non-carious cervical lesions (NCCL).

**Methods** Twenty-four patients were included in the study. A total of 237 NCCL were restored with RC, which were bonded with SBU adhesive that can be used in three different modes. Each three different modes were applied on the same mouth at the same time. Self-etch mode was used for 82 restorations, selective-etch mode was used for 75 restorations, total-etch mode was used for 80 restorations. Then, two blinded, calibrated evaluators assessed the restorations at baseline and 6 months using the FDI criteria. Data were analyzed with the Friedman and Wilcoxon signed-rank tests at a significance level of 5 % ( $P < 0.05$ ).

**Results** At baseline, 14 teeth were scored as 2 for marginal adaptation (5.9%), 4 teeth were scored as 5 for all criteria (1%) and only 1 tooth was scored as 4 for surface roughness (0.04%). After 6-months, 25 teeth were scored as 2 for marginal adaptation (10%), 5 teeth were scored as 5 for all criteria (2%), 2 teeth scored as 2 for fractures and retention (0.08%) and only 1 tooth was scored as 4 for surface roughness and (0.04%) the others were scored as 1 for all other criteria.

**Conclusions** After 6 months, clinical evaluations of the restorations were not significantly different when compared with baseline according to FDI criteria ( $P > 0.05$ ).

0541

**Effect of deproteinization on dentin bond strength of a universal adhesive after different etching procedures**

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**Objectives** The aim of this in vitro study was to evaluate the effect of deproteinization with NaOCl on dentin shear bond strength of a universal adhesive after acid or laser etching.

**Methods** Forty-eight extracted human third molar teeth were sectioned mesiodistally and obtained 96 specimens were mounted in acrylic resin leaving the buccal and lingual surfaces exposed. Exposed flat dentin surfaces were ground with 600-grid SiC paper and then were randomly divided into six groups according to different etching procedures and NaOCl application ( $n = 16$ );

**Groups;** I-II: Universal adhesive (Adhese, Ivoclar/Vivadent) application with/without deproteinization with 10% sodium hypochloride (NaOCl) (no-etch control group); III-IV: Universal adhesive application after 37% phosphoric acid etching with/without deproteinization with 10% NaOCl, V-VI: Universal adhesive application after Erbium, Chromium: Yttrium-Scandium-Gallium-Garnet laser (Er,Cr:YSGG) etching with/without deproteinization with 10% NaOCl. Laser etching was performed with Er,Cr:YSGG laser (2780 nm, Waterlase) at 1.0W with repetition rate 20 Hz and 140  $\mu$ s pulse duration (60% air, 70% water). A cylinder of composite resin (Tetric EvoCeram Bulk Fill) was placed on each sample and light cured. After 24 hours of water storage (37°C), shear bond strength (MPa) was evaluated by universal testing machine at crosshead speed of 1mm/min. Data were statistically analyzed by two-way ANOVA and Bonferroni tests ( $p < 0.05$ ).

**Results** Significant differences were found among all groups irrespective of different etching procedures in non-deproteinized groups ( $p < 0.05$ ). In NaOCl applied groups, universal adhesive group (control group) showed significantly higher dentin bond strength values that were statistically different from acid- and laser-etched groups ( $p < 0.05$ ). While NaOCl deproteinization caused significantly higher bond values in laser-etch group ( $p < 0.05$ ), no significant differences were observed in control and acid-etched groups irrespective of deproteinization ( $p > 0.05$ ).

**Conclusions** NaOCl deproteinization appears to enhance dentin bond strength of laser-etched group.

0542

#### **Dentin Bond Strength Of A Universal And A Self-etch Adhesive**

Pinto, A., Palmares, S., Coito, C., Silva, A., Pequeno, A., Eira, R., Romão, B., Cavalheiro, A.  
University of Lisbon

**Objectives** To compare the immediate microtensile bond strength to dentin of a universal adhesive system (Scotchbond Universal Adhesive, 3M ESPE, St Paul, MN, USA) in self-etch technique, with a two-step self-etch adhesive (Clearfil SE Bond, Kuraray, Okayama, Japan).

**Methods** Six caries-free human third molars were used to obtain crown segments by exposing middle dentin and then randomly distributed into two groups according to the different adhesive systems used: 1) Scotchbond Universal applied as one-step self-etch adhesive (SBU SE D) and 2) Clearfil SE applied as two-step self-etch adhesive (CL SE D), both per manufacturer's instructions. Resin composite build-ups (UD4, ENAMEL plus HRi, Micerium S.p.A. Avegno, GE, Italy) were applied in increments of 2 mm each, until a height of 6mm: each layer was light cured for 20 seconds with an additional light polymerization performed on mesial, distal, facial and lingual surfaces for 10 seconds. The teeth were then stored in distilled water in an incubator (24h/37°C). Specimens were sectioned to obtain sticks with 1mm<sup>2</sup> of cross sectional area, that were tested to failure in a universal testing machine at a crosshead speed of 1mm/min to assess dentin microtensile bond strength ( $\mu$ TBS). Data were analyzed with a parametric paired-sample t test when the assumption of normality was valid ( $\alpha=0,05$ ).

**Results** SBU SE D showed higher  $\mu$ TBS mean ( $41.03 \pm 19.31$  MPa) than CL SE D ( $36.70 \pm 17.77$  MPa), nevertheless the comparison between these two adhesive systems revealed no significant statistical differences ( $p > 0,05$ ).

**Conclusions** The universal adhesive tested in this study, when used in self-etch mode, seems to have an immediate performance on dentin similar to the more conventional two-step self-etch adhesive Clearfil SE Bond.

0543

#### **Dentin Bond Strength of a Universal Adhesive System**

Palmares, S., Pinto, A., Coito, C., Pequeno, A., Eira, R., Silva, A., Romão, B., Cavalheiro, A.  
Lisbon University

**Objectives** To compare the immediate microtensile bond strength of one universal adhesive system (Scotchbond Universal Adhesive, 3M ESPE, St Paul, MN) applied to dentin according to the etch-and-rinse and the self-etch technique.

**Methods** Six recently extracted human third molars, intact and without macroscopic evidence of caries or restorations, were assigned to two groups according to the etching strategy: 1) SBU TE D – Scotchbond Universal Adhesive applied as a 2-step etch-and-rinse adhesive on moist dentin and 2) SBU SE D - Scotchbond Universal Adhesive applied as a 1-step self-etch adhesive on moist dentin, both per manufacturer's instructions. Resin composite build-ups (UD4 ENAMEL Plus HRi, Micerium S.p.A. Avegno, GE, Italy) were applied in three increments of 2 mm each, until a height of 6 mm: each layer was light cured for 20 seconds with an additional light polymerization performed on facial, lingual, mesial and distal surfaces for 10 seconds. The teeth were stored in distilled water in an incubator (24h/37°C). Specimens were sectioned to obtain sticks with 1mm<sup>2</sup> of cross sectional area, that were tested to failure in a universal testing machine at a crosshead speed of 1mm/minute, to assess dentin microtensile bond strength ( $\mu$ TBS). A paired-sample t-test was performed when the assumption of normality was valid ( $\alpha=0,05$ ).

**Results** The mean  $\mu$ TBS of the SBU SE D group ( $56,9 \pm 2,5$  MPa) was statistically higher than SBU TE D ( $48,0 \pm 2,1$  MPa) ( $p < 0,05$ ).

**Conclusions** It may be concluded that improved bonding effectiveness of Scotchbond Universal Adhesive to dentin seems to be obtained when the adhesive is applied with the self-etch approach.

0544

# **Bond-strength comparison of a new universal adhesive to a gold-standard**

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<sup>1</sup>University Medical Center of the Johannes Gutenberg University, <sup>2</sup>Heraeus Kulzer GmbH

**Objectives** Aim of this study was to compare the shear bond strength of the new 1-step/1-bottle-adhesive iBOND Universal (iBUN, Heraeus Kulzer) applied in an etch & rinse and in a self-etch technique to a 3-step/2-bottle-adhesive Optibond FL (OFL, Kerr) initially and after thermocycling.

**Methods** Eighty-four flat dentin specimens were prepared from bovine incisors and embedded into acrylic resin. Dentin surfaces were roughened using SiC paper 320 to imitate smear layer. Twenty-eight undergraduate dental students were asked to apply iBUN in a self-etch and in an etch-rinse mode as well as OFL on the dentin specimens (n=14). All adhesives were used according to their instructions for use. For the iBUN E&R-group and OFL, the dentin was etched with iBOND Etch 35 Gel (Heraeus Kulzer). After air-drying and light curing, 10s for iBUN, 20s for OFL (Translux Wave, Heraeus Kulzer) by the students, composite cylinders (Venus Pearl A2, Heraeus Kulzer) were placed on the bonded surface, using the Ultradent equipment, and light cured. Half of the specimens were stored in water at 37°C for 24h, whereas the other half were additionally thermocycled (5000 cycles, at 5°C and 55°C). Shear bond strength was then determined using a universal testing machine (Ultradent) at a crosshead speed of 1mm/min. Statistical analysis was performed using ANOVA followed by LSD post-hoc test (p<0.05).

**Results** Shear bond strengths (MPa) for specimens initially/after thermocycling were: Optibond FL 31/24, iBOND Universal Etch&Rinse 33/25, iBOND Universal Self-Etch 28/24. Same letter denotes no statistical significant difference between groups (Figure 1).

**Conclusions** iBUN showed bond strength both in etch & rinse and self-etch bonding technique comparable to the gold-standard OFL even after thermocycling. iBOND Universal exhibited low technique sensitivity even for inexperienced users.

0545

# **Bonding Performance Of One-Step Multi-Mode Adhesive On Dentin Contaminated With A Mixture Of Saliva And Blood**

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**Objectives** The aim of this in vitro study was to evaluate the effect of saliva-blood mixture contamination (MC) on micro-shear bond strength (µSBS) of one-step multi-mode adhesive (SBU, Scotchbond Universal Adhesive, 3M ESPE, MN, USA) to dentin surfaces with or without acid etching (AE - 37% phosphoric acid).

**Methods** Twenty-four non-carious human molar teeth were sectioned mesio-distally below the dentino-enamel junction to obtain 2 mm thickness dentin slabs. Each slab was re-sectioned mesio-distally and bucco-lingually, yielding 4 slabs and then embedded in acrylic resin by leaving occlusal dentin surfaces uncovered. Dentin surfaces were contaminated with blood and saliva mixture (MC). All contaminated dentin surfaces were then cleansed with water for 5 seconds (s), followed by air-drying. Experimental groups (G) were as follows (n=16):

G1= w/o MC + w/SBU.

G2= w/o MC + w/AE-10 s + w/SBU.

G3= w/o MC +w/AE-20 s + w/SBU.

G4= w/MC + w/ SBU.

G5= w/MC + w/AE-10 s + w/SBU.

G6= w/MC + w/AE-20 s + w/SBU.

All cylindrical composite resin samples (2.1-mm in diameter, 3-mm in height) were prepared in plastic tubes and were bonded to dentin surfaces with SBU in a special alignment apparatus under a load of 1000 g and µSBS values were measured. Results were analyzed with ANOVA and Tukey's HSD (p<0.05).

**Results** There was no interaction between adhesive application and contamination (p<0.05). Bond strength values were significantly reduced in contaminated groups (p<0.05). AE cleansing improved bond strengths of SBU to dentin in all groups (p<0.05).

**Conclusions** The mixture of blood and saliva contamination negatively affected bond strength values of one-step multi-mode adhesive. Application of phosphoric acid (%37) for 10 or 20 s to cleanse the dentin surface improved the bond strength to dentin.

Strenght Values of Study Groups

GROUPS	Bond Strength Value(Mean± SD)
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G1	16.2±5.4b
G2	25,1±7dc
G3	28.1±6.5d
G4	7.9±1.3a
G5	21.7±3.5c
G6	24.6±3.8dc

Means with same letter are not significantly different

0546

#### **Bonding Performance of One-Step Multi-Mode Adhesive on Blood Contaminated Dentin**

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**Objectives:** The aim of this in vitro study was to evaluate the effect of blood contamination on micro-shear bond strength ( $\mu$ SBS) of one-step multi-mode adhesive (SBU - Scotchbond Universal Adhesive, 3M ESPE, MN, USA) to dentin surfaces with or without acid etch (AE- 37% phosphoric acid) cleansing.

**Methods:** Twenty-four non-carious human molar teeth were sectioned mesio-distally below dentino-enamel junction to

obtain 2 mm-thick dentin slabs. Each slab was re-sectioned mesio-distally and bucco-lingually, yielding 4 slabs and then embedded in acrylic resin by leaving occlusal dentin surfaces uncovered. Half of the specimens were contaminated with blood (BC). Other half was kept uncontaminated. All contaminated dentin surfaces were then cleansed with water for 5 seconds (s), followed by air-drying. Experimental groups (G) were as follows (n=16):

G1= no BC + SBU

G2= no BC + AE-10 s + SBU

G3= no BC + AE-20 s + SBU

G4= BC + SBU

G5= BC + AE-10 s + SBU

G6= BC + AE-20 s + SBU

All cylindrical composite resin samples (2.1-mm in diameter, 3-mm in height) were prepared in plastic tubes and were

bonded to dentin surfaces with SBU in a special alignment apparatus under a load of 1000 g and  $\mu$ SBS values were measured. Results were analyzed with 2-way ANOVA and Tukey's HSD ( $p<0.05$ ).

**Results:** There was no interaction between adhesive application and contamination ( $p<0.05$ ). Bond strength was lowest in BC-only group (G4) ( $p<0.05$ ). AE cleansing improved bond strengths of SBU to dentin in BC and no-BC groups ( $p<0.05$ ).

**Conclusions:** Bond strength values of one-step multi-mode adhesive were negatively affected by blood contamination.

Application of phosphoric acid (%37) for 10 or 20 s to cleanse the dentin surface improved the bond strength to dentin.

0547

#### **Bonding Performance Of The One-Step Multi-Mode Adhesive On The Saliva Contaminated Dentin**

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**Objectives** The aim of this in vitro study was to evaluate; the effect of saliva contamination on microshear bond strength of one-step multi-mode adhesive (SBU-3M ESPE, Scotchbond Universal Adhesive, MN, USA) to dentin surfaces with or without acid etch (AE-37% phosphoric acid) application.

**Methods** Twenty four non-carious human molar teeth were sectioned mesio-distally below the dentino-enamel junction to obtain 2 mm thickness dentin slabs. All slabs were re-sectioned mesio-distally and bucco-lingually and embedded in acrylic resin by leaving occlusal dentin surfaces uncovered. Each test group comprised 4 teeth and 16

dentin sections. The dentin surfaces were contaminated with saliva(SC). The all contaminated dentin surfaces of the samples were cleansed with the water steam from an air-water syringe-5 seconds(s), followed by a dried with air. The contaminations and adhesive application steps as follows:G1=w/o SC + w/SBU.G2=w/o SC + w/AE-10 s + w/SBU.G3=w/o SC +w/AE-20 s + w/SBU.G4=w/SC + w/ SBU. G5=w/SC + w/AE-10 s + w/SBU.G6=w/SC + w/AE-20 s + w/SBU. All cylindrical composite resin samples(2.1 mm in diameter,3 mm in height) were prepared with plastic tubes and were bonded to dentin surfaces with the SBU in a special alignment apparatus under a load of 1000g. Microshear bond strengths were measured. The results were analyzed with Two-ANOVA and Tukey's HSD. Results There was no interaction between adhesive application and contamination( $p<0.05$ ). Bond strength values were significantly reduced after the dentin contaminations in all groups( $p<0.05$ ). The cleansing protocols with acid etch application influenced bond strength of SBU to dentin( $p<0.05$ ). Conclusions Bond strength values of SBU were more affected by the contaminations. Acid etch application for the cleansing protocol was increased to bond strength of SBU.

Microshear bond strength results of all experimental groups

Groups	Bond Strength Value(Mean± SD)
G1	15.2±4.4b
G2	21,9±6.2c
G3	24.8±5.5c
G4	10.3±3.3a
G5	20.2±4.5c
G6	23.6±3.6c

Same superscript letters demonstrate no significant differences ( $P<.05$ ).

0548

**Bond strength and microleakage of universal adhesives used in self-etching mode.**

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**Objectives** To assess the bond strength with dentine and microleakage in class V cavities of universal dental adhesives based on 10-MDP when used in the self-etch mode.

**Methods** The adhesives tested were All Bond Universal (AB), Adhese Universal (AD), Clearfil Universal Bond (CB), Single Bond Universal (SB) and the restorative material Tetric EvoCeram. For shear bond strength with dentine (SBS), intact extracted third molars (n=10x4) were horizontally sectioned, polished under water and covered with a self-adhesive tape with a hole of Ø:5mm located at the center of each tooth. The exposed dentine was treated with each adhesive as per the instructions and composite cylinders (Ø:3.5mm,h:2mm) were bonded onto. After water-storage (1w/37°C), the composite rods were sheared off from dentine at 1mm/min speed. Dentine surfaces were further examined under a stereomicroscope to characterize the mode of failure (MF). For microleakage testing, standardized class V cavities (n=10x4) were prepared at the buccal and lingual surfaces of sound premolars, with the cervical margins placed below (buccal/B) or above (lingual/L) the dentine-enamel junction. Cavities were treated only by the adhesives and restored with a single-composite layer. Tooth crowns were immersed in 1.5% fuschin solution for 24h and longitudinally sectioned through the restorations. The extent of microleakage (ML) was assessed using a 0-3 score scale. Statistical analysis was performed by 1-way ANOVA(SBS), X<sup>2</sup> (MF) and 2-way ANOVA on Ranks(ML) at  $\alpha=0.05$ .

**Results** The SBS values recorded were (means/sds,MPa): AB:25.1(5.3), AD:26.3(4.9),CB:26.5(4.3),SB:25.6(3.7). All failures were mixed. No statistically significant differences were found in SBS and MF. The results for ML were (median/25%-75%,score): ABB:0(0-2),ADB:0(0-0),CBB:0.5(0-1),SBB:0.5(0-2),ABL:1(0-2),ADL:0(0-1),CBL:0(0-2),SBL:0(0-1). No significant differences were found in factors material, cavity location or their interaction ( $p>0.05$ ).

**Conclusions** The lack of statistically significant differences in the properties tested may imply similar clinical performance for the 10-MDP based adhesives tested, when used in the self-etch mode

0549

**Nanoleakage with a Universal and a Self-etch Adhesive: application deviations**

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University of Lisbon

**Objectives** To evaluate the nanoleakage patterns in the resin-dentin interfaces, with different deviations on the application protocol of a universal and a two-step self-etch adhesive systems, observed by the scanning electron microscopy (SEM).

**Methods** Twelve intact, non-carious human molar teeth (N=12) were randomly divided into 6 groups and treated with two different adhesive systems: Scotchbond Universal Adhesive (SBU) (3M ESPE, St. Paul, MN, USA) and Clearfil SE Bond (CL) (Kuraray, Okayama, Japan). SBU was applied in etch-and-rinse and self-etch mode according to the manufacturer's instructions (groups SBU TE and SBU SE) and with a variation of the protocol with the application of an additional hydrophobic resin, Adper Scotchbond Multipurpose adhesive (3M ESPE, St. Paul, MN, USA) (groups SBU TE+A and SBU SE+A). CL was applied in self-etch mode according to the manufacturer's instructions (group CL SE) and with a variation of the protocol: in etch-and-rinse mode (group CL TE). Sample sticks from each tooth were impregnated with ammoniacal silver nitrate (50% wt; pH=9,5), processed to conventional methods for SEM and observed under a scanning electron microscope on backscattered mode.

**Results** SBU presented the lowest quantity of nanoleakage in SBU TE+A and SBU SE+A groups, and the highest in the SBU TE group. Among all the six groups tested, the group CL SE showed the lowest amount of nanoleakage.

**Conclusions** The performance of the adhesives tested proved to be dependent on the adhesive strategy used. The application of the adhesive systems in self-etch mode seems to provide a better dentin sealing, with less nanoleakage than when applied in etch-and-rinse mode.

0551

**Mineral and matrix composition of irradiated human mandible**

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**Objectives** Pre and post-operative radiotherapy is considered as essential part of treatment regimen for oral cancer patients. However, placing dental-implants in previously irradiated tissue poses clinical problems such as peri-implantitis or osteoradionecrosis which impair the success of the implant. The aim of this study was to determine biochemical alterations in human mandible bone after irradiation using Raman microspectroscopy.

**Methods** A total 36 bone biopsies of 10 x 5 mm obtained from 21-control, 4-cancer and 11-irradiated 4 oral cancer patients at the time of oral surgery were used. After fixation, dehydration and embedding in polymethyl methacrylate, Raman measurements were carried out under pathological supervision. Three spot measurements with an acquisition time of 60s were conducted. Unpaired student 't' test was employed to measure level of significance. **Results** Absolute mineral contents (phosphate and carbonate) were higher in cancer specimens. Significant differences ( $p < 0.05$ ) were observed between carbonate substitution rates of cancerous, control and irradiated specimens. Mineral crystallinity, collagen content and mineral to matrix ratios were significantly lower in cancerous specimen as compare to irradiated and control specimens.

**Conclusions** Findings of the study indicate that Raman spectroscopy methods can be used to study radiation induced alterations in biochemical and structural composition in human mandible bone. Major changes were observed in control-cancerous and cancer-irradiated cases. Control and irradiated specimens show no differences in the mineral and organic matrix composition, suggesting reversal of disease induced changes.

0552

**Ablative potential of Er:YAG laser: quantum square pulse mode versus new digitally controlled dental laser handpiece (X-runner)**

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**Objectives** The primary objective of this *in vitro* study was to compare ablated volume and dentin ablation rate of quantum square pulse (QSP), using two different pulse energy settings, and a new digitally controlled dental laser handpiece (X-runner) in QSP mode. The secondary objective was to examine the effects of the ablation with different Er:YAG laser modes on dentin surface using SEM.

**Methods** Freshly extracted human molars (n=36) were divided into three experimental groups. Cavity preparations were made in dentin as follows: 1) QSP with pulse energy of 250 mJ; 2) QSP with pulse energy of 500 mJ and 3) X-runner in QSP mode with pulse energy of 250 mJ, at time intervals of 1, 2 and 5 seconds. A laser triangulation profilometer was used to determine cavity volumes and SEM analysis was performed to examine the surface of cavity preparation surfaces in all experimental groups.

**Results** There was a significant difference in ablated volume and ablation rate for QSP (pulse energy 250 mJ) and X-runner groups and between QSP (pulse energy 500 mJ) vs. QSP mode (pulse energy 250 mJ) for all examined time periods ( $p < 0.05$ ). There was no significant difference in ablated volume and ablation rate between X-runner and QSP mode (pulse energy 500 mJ), ( $p > 0.05$ ). In all laser groups, except the group where X-runner was used, dentin surface was free of smear layer, exhibiting open dentinal tubules.

**Conclusions** A larger volume of dentin was removed and with higher ablation rate in X-runner group in comparison to QSP mode with pulse energy of 250 mJ. There was no difference in ablated volume and ablation rate between X-runner and QSP mode with pulse energy of 500 mJ. Out of all the examined laser groups, only the X-runner group exhibited smear layer and closed dental tubules in the SEM analysis.

0553

**The effect of laser treatment on total MMP activity.**

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**Objectives** Matrix metalloproteinases (MMPs) bound to dentin have been thought to contribute to the progressive degradation of collagen fibrils in hybrid layers. The aim of this study was to evaluate the effect of laser treatment of dentin on total MMP activity.

**Methods** Generic colorimetric MMP assay was used to determine if laser pretreatment of dentin could activate dentin-derived endogenous MMPs, using 10 mineralized beams (0.3x5x6mm) for each group. Groups were: (1) Control group; application of 37% phosphoric acid (PA) for 15 sec; (2) irradiation with Er:YAG laser (120mj, 10 Hz); (3) irradiation with Er:YAG laser with scanner handpiece (X Runner, Fotona; 120mj, 10 Hz); (4) irradiation with Er:Cr:YSGG laser (4W, 30Hz). After laser treatment the beams were individually incubated in 300 µL of chromogenic thiopeptide substrate and assay buffer (Sensolyte Generic MMP assay; Anaspec) in a 96-well plate for 60 min at 25 °C. After incubation the developed color was measured at 412 nm. Data were analyzed using ANOVA/Tukey (p<0.05)

**Results** ANOVA showed significant differences among tested groups (p<0.001). Laser treated beams showed 55-75% less activity compared to 37% phosphoric acid treated beams.

**Conclusions** The use of dental laser treatment of the dentin showed significantly less matrix metalloproteinases-mediated collagen degradation compared to phosphoric acid etching. TUBITAK-112S711

0554

**Crystallographic Analyses of Coronary and Root Dentin: a Pilot Study**

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**Objectives** The aim of this study was to provide information on the differences in the crystal properties and ultrastructure of coronary and root dentin.

**Methods** The samples for this investigation were taken from the coronary and root sections of freshly extracted human teeth. The analysis was carried out by means of Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), as well as simultaneous thermogravimetric and differential thermal analysis (DTA).

**Results** In the FTIR profiles obtained from the samples, the four major bands – OH, amides, carbonate and phosphate were recorded for both root and coronary dentin. The differences between the two groups of dentin were in the sharpness and the heights of the peaks, indicating a higher level of crystallinity of the coronary dentin. The X-ray diffraction analysis showed differences in the intensity of the peaks. In addition, some peaks in the root dentin samples were merged together, indicating a lower level of crystallinity. The average crystallite size of the two groups was calculated – 11 nm for coronary dentin and 23 nm for root dentin. The differential thermal analysis showed three weight losses, corresponding to the evaporation of water, the oxidation of organic matter and the decomposition of mineral carbonates. The DTA curve showed the decomposition of organic matter as an exothermic reaction with two peaks, with an endothermic peak in between. The biggest weight loss between the two groups was recorded at the decomposition of mineral carbonates – 4.6% for the coronary dentin and 8.3% for the root dentin.

**Conclusions** Our study showed that, although the main component of root and coronary dentin is hydroxyapatite, there are ultra structural differences between them. Therefore, FTIR, XRD and DTA are useful techniques for studying the crystallographic properties of human dentin.

0555

### **Conservative Treatment of the Dentigerous Cyst: A Case Report**

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**Objectives** Dentigerous cysts are the second most common developmental odontogenic cysts after those related to the roots of the teeth (periapical cyst). It is a benign and asymptomatic intraosseous lesion interfering with tooth eruption. They rarely seen in childhood because they almost exclusively occur in secondary dentition. Typically dentigerous cysts are painless and discovered during routine radiographic examination. However, it can cause expansion in cortical bone and facial asymmetry.

Although enucleation is the treatment of choice, marsupialization is the better option for large cysts involving unerupted permanent teeth because by this way the impacted tooth can be maintained and eruption can be provided. **Methods** A 12 year old male patient was referred to Erciyes University Department of Pediatric Dentistry with a complaint of swelling in mandibula for a month. Radiographically an extensively unilocular cyst was examined at the right side of mandibula associated to first premolar tooth.

**Results** Marsupialization was preferred in our case and eruption of permanent teeth was achieved. First year follow-up, asymptomatic tooth, clinic and radiographic healing observed.

**Conclusions** Marsupialization and decompression are very low invasive techniques that could easily be conducted by any dentist familiar with basic surgical procedures, in order to treat the pathology and preserve the tooth or teeth involved with the cyst.

0556

### **CONSERVATIVE TREATMENT OF A PATIENT WITH PYCNODYSTOSIS-A CASE REPORT**

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Erciyes University

**Objectives** A rare inherited biochemical autosomal recessive disorder involving an enzyme (cathepsin k) deficiency which impairs the processes needed to maintain healthy bones. So the bones of people with pycnodysostosis (PYCD) are brittle and breakable, even under minimal stress. Fractures are common in affected people's legs, feet, jaws, and collar bone.

The precise frequency of PYCD estimated prevalence rate is one in one million.

PYCD is characterized by dwarfism.(59 inches, or 4 feet 1 inch).

Oral and maxillofacial manifestations include hypoplasia of the mandible and maxillary sinus, obtuse mandibular gonial angle, deciduous teeth and permanent impacts, or malposition, premature or delayed eruption, relative mandibular prognathism, frequent overcrowding, periodontal lesions, enamel hypoplasia and grooved palate.

**Methods** A 10-year-old female patient referred to our clinic (Erciyes University Department of Pediatric Dentistry) with a diagnosis of PYCD. Parents of our patient gave a history revealed that at 5 years of age, the patient had a complete survey in a private medical clinic to investigate growth retardation.

Extra-oral clinical examinations showed short stature, narrow shoulders, frontal bulge, and disproportion of the size of her head with face. Mouth breathing and atypical swallowing were noted. The intra-oral clinical and radiographic inspection showed that anterior open bite, posterior cross bite, deep palate, mandibular and maxillary atresia, generalized gingivitis with poor oral hygiene, dental caries and taurodontism.

**Results** The patient referred to the Department of Orthodontics in our Faculty after caries lesions treated with composite and amalgam restorations (with or without root canal treatments).

**Conclusions** The differential diagnosis of PYCD should be lots of bone diseases, particularly cleidocranial dysostosis, acroosteolysis, osteogenesis imperfecta, and osteopetrosis.

Because of intra-oral alterations described previously, child patients with PYCD should receive special dental care. Especially preventive treatments should be implemented in addition to periodical follow-up of their growth and craniofacial development.

**0558**

**Management of Generalized Gingival Fibromatosis in a Case with Frank-Ter Haar Syndrome**

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**Objectives** Frank-Ter Haar syndrome (FTHS) is a rare skeletal dysplasia and characterized by multiple skeletal abnormalities, developmental delay, cardiac defects and characteristic facial features. The main clinical features are brachycephaly, wide fontanelles, prominent forehead, hypertelorism, prominent eyes, macrocornea with or without glaucoma, full cheeks, small chin, bowing of the long bones and flexion deformities of the fingers. Less than 30 cases have been reported in the literature and very little is known about oral and dental features of these cases.

Gingival fibromatosis (GF) is a rare, genetically inherited overgrowth condition that is clinically characterized by a benign fibrous enlargement of maxillary and mandibular keratinized gingiva. A syndromic association between gingival fibromatosis and a wide variety of other genetically inherited disorders has been described. However, its coexistence with FTHS has not been reported.

The aim of this case report is to describe oral and dental features of a case with FTHS and to present the treatment of generalized GF.

**Methods** A 4.5-year-old girl who has been diagnosed as FTHS was referred to our clinic for the complaint of swollen gums and mastication problems. Clinical examination revealed severe gingival overgrowth on both mandible and maxilla. Only the incisal edge of the mandibular incisors could be seen. Surgical therapy included gingivectomy and gingivoplasty has been performed.

**Results** Removal of fibrotic gingival tissue represents a unique treatment approach.

**Conclusions** And no recurrence of GF was observed 18-months after the treatment.

**0560**

**Management of a premolar tooth with Turner's hypoplasia and internal resorption: A case report**

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ONDOKUZ MAYIS UNIVERSITY

**Objectives** Hypoplasia is the result of disruption in the process of enamel matrix formation, which in turn causes defect in quality and thickness of enamel. The aim of this study was to present the treatment of a tooth with Turner's hypoplasia and internal resorption.

**Methods** Orthopanthography and periapical radiography were taken for radiographic examination. Radiographic examinations showed the left lower jaw permanent second premolar tooth with internal root resorption and periodontal lesion. Extraction of tooth was decided as a treatment choice and endodontic treatment was planned for the left lower jaw permanent first molar tooth.

**Results** Pathologies in primary teeth can affect on the mineralization of permanent teeth. Therefore, treatments in the primary teeth should not postpone.

**Conclusions** Detailed clinical and radiographic examination of teeth with Turner's hypoplasia are important. Early examination and treatment of these teeth will keep the tooth in the mouth for a long time.

**0561**

**Report of two familial cases with congenitally missing mandibular incisors**

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Necmettin Erbakan University

**Objectives** Tooth agenesis is one of the most common congenital anomalies seen in humans. Although one or more missing teeth is common but multiple missing teeth is rare. Hypodontia describes the situation that congenital absence of less than six teeth and oligodontia means congenital lack of more than six teeth excluding third molars. The most encountered congenitally missing permanent teeth are; respectively third molars (%9-30), mandibular second premolar (3.4%) and the maxillary lateral incisor (2.2%). The absence of teeth may be unilateral or bilateral. There are a few reports including unilateral agenesis of permanent mandibular central incisors but agenesis of bilateral mandibular central incisors and its familial history is documented inadequately. The prevalence of oligodontia in permanent dentition was reported as 0.14% in the literature. The aim of these present cases are to report bilateral congenitally missing permanent mandibular central incisors and it's treatment prognosis.

**Methods** In these case reports were presented clinical findings and rehabilitation of two patients suffered from oligodontia and hypodontia which characterized with bilateral congenitally missing permanent mandibular central incisors. In both cases was also detected the familial transmission and congenitally bilateral lack of permanent mandibular central incisors. To ensure optimum function and aesthetics, the mandibular anterior teeth of patients were made aesthetic rehabilitation. Also, complete scaling and needed restorations were performed.

**Results** As a result, pretreatment, posttreatment, and short-term follow-up records of these patients are presented. Patients who underwent the restoration was achieved an adequate function and aesthetics.

**Conclusions** Early diagnosis and comprehensive treatment planning and the correct treatment options appropriate to the individual are important for a successful treatment outcome.

**0562**

**Different Treatment Approaches Of Traumatic Injuries With Complicated Crown Fracture**

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**Objectives** Traumatic anterior tooth fracture is commonly occurred in dentistry. Loss of function and aesthetic caused by trauma; provoke physical and psychological effects on patients. When the restorative alternatives are evaluated; loss of tooth structure, pulpal situation of tooth and patient demands should be considered. It is declared that restorations which supported from the root of the excessive crown fractured and pulpal damaged tooth; are more long lasting. Besides restorations in which own fractured fragment is used are aesthetically more satisfying.

**Methods** Complicated crown fractures were observed in four patient who admitted to Necmettin Erbakan University Dentistry Faculty Pedodontics Clinic after trauma. Following clinical and radiological evaluation, endodontic and restorative treatment was planned according to vitality, location of fracture and root development of teeth. In the case of open apex, apexification with MTA was performed and root canal treatment of tooth with closed apex was done using gutta-percha. In addition CVEK amputation was performed for the tooth which had a small pulpal perforation. After endodontic protocol all of the crown restorations were supported with poliethylen fiber excluding the vital tooth. Two of the teeth were restored with their own fractured fragments and others were restored with composite resins.

**Results** Endodontic and restorative treatments of all patients were performed and results were satisfying. The follow up sessions of all patients are going on.

**Conclusions** There are many treatment alternatives for restoration of traumatized teeth according to location of fracture and stage of root development. Apexification treatments performed with MTA are reported to be completed in a shorter period, have more successful healing process and less sessions so MTA seems to be an ideal material for apexification. Beside this, supporting the coronal restorations of traumatize teeth with polyethylen fiber is recommended for strengthening remaining tooth structure replace the loss in crown and ensure the aesthetic appearance.



0563

**Norwegian dentists' treatment approach to severe caries in preschool children**

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**Objectives** The purpose of this study was to identify Norwegian dentists' different approaches to severe caries in a healthy five year old child.

**Methods** A precoded questionnaire (QuestBack) was sent electronically to all dentists working in the Public Dental Health Service (PDHS) in eight counties in Norway. One question included a hypothetical patient case accompanied by two BW radiographs demonstrating severe caries in the primary dentition. The question was followed by a list of possible treatment options. The participants were asked to select one or two of the most preferred treatment alternatives. Dentists also reported on sex and how often they used conscious sedation. Data was analyzed by cross tabulation, chi-square statistics with  $p < 0.05$  as level of statistical significance.

**Results** A total of 611 dentists received the questionnaire and 391 (65%) returned the completed form. There were no statistical differences between the study sample and all PDHS dentists in Norway with respect to age ( $p = 0.31$ ) and sex distribution ( $p = 0.43$ ). Of the respondents, 168 (43.0 %) chose one treatment alternative, 203 (51.9 %) chose two preferred treatment options and 20 (5.1%) did not answer the question. The number of dentists who chose the treatment option: "new appointment for behavioural management technique" was 255 (65.2%) and 196 (50.1%) ticked the alternative "new appointment with use of sedation". The option "acute treatment and if necessary hold the child" was reported by 45 dentists (11.7%). There was an association between dentists who used sedation regularly and the treatment option with sedation ( $p = 0.03$ ) with no sex difference.

**Conclusions** This survey demonstrated that dentists who frequently use sedation would choose dental treatment under sedation in children with severe caries. The use of sedation is essential to provide optimal dental care, and dental treatment rendered under sedation should be emphasised in dental undergraduate and continuing training programs.

0564

**Association between quality of life and dental anxiety in 5-7 year-old children**

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**Objectives** Research in adults indicates that psychological well-being and social functioning are factors associated with dental anxiety. Highly fearful dental patients report lower scores for psychological well-being, and social functioning than non-fearful patients. The aim is determine the association between dental anxiety and quality of life parameters in children.

**Methods** This is a cross-sectional study conducted with 784 children with 5 to 7 years old. A face-to-face interview was conducted with parents. The DAQ answers were categorized as presence or absence of dental anxiety. To evaluate the quality of life the Short Form Health Survey-10 for Children (SF-10) was used. It is composed by eight domains of health: physical functioning, role limitations due to physical health, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems and mental health. Forward logistic binary regression was performed for the multivariate analysis. This analysis was stratified by income and controlled by sex and age.

**Results** The prevalence of dental anxiety was 42 %. There was an inverse relationship between quality of life and dental anxiety in children from lower socioeconomic conditions. This association was not found in children from higher socioeconomic conditions. Children who reported impact on physical functioning had a 1.8 (95% CI: 1.1-3.1) times greater chance to report high dental anxiety in comparison to children without limitations. Similarly, children who reported impact on social functioning had 1.5 (95% CI: 1.0-2.3) times greater chance to report high dental anxiety in comparison to children without limitations independent of age of child and gender.

**Conclusions** There was an inverse relationship between quality of life and dental anxiety in children from lower socioeconomic conditions. In dentistry efforts should be made to teach children about dentistry and dental procedures and learn strategies to cope with dental care to increase their sense of self-efficacy.

0565

### **Delayed Reimplantation of Avulsed Teeth: Two Case Reports**

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Institute of Health Sciences

**Objectives** Tooth avulsion is a complex injury that affects the pulp tissue, periodontal ligament and alveolar bone. This article presents management of two cases with avulsed permanent incisors with closed apices that were stored in dry conditions for more than two hours.

**Methods** One of the cases was a girl aged 10 years old who referred to Ege University Department of Pedodontics with an avulsed maxillary central incisor with delay of 4 hours. The other case was a boy aged 10 years old with an avulsed mandibular central incisor with delay of 3 hours. In both cases reimplantations were carried out by rinsing the avulsed teeth carefully with saline and removing all the contaminants. The avulsed teeth were slowly reimplanted with digital pressure. Splinting of the avulsed teeth were done with a semi rigid splint for 10 days. Prophylactic antibiotics were prescribed for both patients. Root canal treatments were initiated within a week after reimplantations.

**Results** During the follow-up periods of one year the teeth were functional and showed no signs of external resorption or any other pathological findings.

**Conclusions** Even though the long term prognosis is uncertain, this treatment technique has many advantages for the young patient by maintaining the esthetics and function as well as the maintenance of the height of alveolar bone.

0566

### **The effects of metabolic risk factors on periodontal health and saliva myeloperoxidase levels in menopause**

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**Objectives** Menopause is a physiological process which increases susceptibility to periodontal disease and metabolic problems. Saliva has been used commonly as a diagnostic fluid for periodontal and systemic diseases. Myeloperoxidase (MPO) is secreted by neutrophils and it has a great role in protective mechanism of the saliva. The aim of this study was to evaluate the multiple effects of metabolic risk factors on periodontal health and saliva MPO levels in menopausal women.

**Methods** 176 women, between 30-70 years old, were categorized according to the menopausal status as premenopause (n=86) or postmenopause (n=90) and count of the metabolic risk factors. Sociodemographics and systemic status was determined via questionnaire and medical records. Clinical periodontal parameters and saliva MPO levels were measured.

**Results** In menopause, they were increased, not only the periodontal parameter values but also count of metabolic risk factors. Periodontal parameters were positively correlated with body mass index, abdominal obesity, total cholesterol, triglyceride, fasting blood glucose, creatinine, aspartate aminotransferase, blood urea nitrogen and neutrophil/lymphocyte ratio but negatively correlated with saliva volume. Saliva MPO levels were higher in postmenopausal group than those in premenopausal group. Also it was positively correlated with clinical attachment level, triglyceride, and total cholesterol/high density lipoprotein ratio.

**Conclusions** It could be considered that in menopause more metabolic risk factors, greater periodontal breakdown. Salivary MPO may be an indicator in systemically and periodontally inflammation.

0567

**Measurement of Oncostatin M, Leukemia Inhibitory Factor and Interleukin-11 Levels in Serum, Saliva and Gingival Crevicular Fluid of Patients with Periodontal Disease**

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**Objectives** The aim of this study is to determine levels of OSM, LIF and IL-11 in GCF, saliva and serum in periodontally healthy individuals, and in individuals with gingivitis and chronic periodontitis before and after periodontal treatment; and to evaluate the relationship between these cytokine levels and clinical periodontal parameters.

**Methods** 72 systemically healthy individuals were included in the study. The individuals were divided into three groups as 24 periodontally healthy (Group I), 24 gingivitis (Group II) and 24 chronic periodontitis patients (Group III). Initially, GCF, saliva and serum samples were collected and clinical periodontal measurements including PI, GI, PD and CAL were recorded. After 8 weeks from initial periodontal treatment, the parameters were recorded again in Groups II and III. Cytokine levels were determined by ELISA and then the results were statistically evaluated.

**Results** OSM levels in GCF, saliva and serum in Group III were statistically higher ( $p < 0.05$ ) compared to other groups. Although LIF levels in GCF exhibited a significant increase ( $p < 0.05$ ) in Group III, there wasn't any significant difference in serum and saliva LIF levels among groups ( $p > 0.05$ ). IL-11 levels in Group III was significantly higher ( $p < 0.05$ ) compared to other groups, but there was no difference in serum IL-11 levels between groups ( $p > 0.05$ ). While saliva IL-11 levels in Group III were significantly higher compared to Group I ( $p < 0.05$ ); there was no significant difference compared to Group II ( $p > 0.05$ ). Comparison of DOS and saliva OSM and IL-11 levels in Groups II and III before and after periodontal initial therapy, these levels were found significantly lower in both groups after therapy ( $p < 0.05$ ). Saliva OSM and LIF levels revealed positive correlations with CAL.

**Conclusions :** Increase in OSM, LIF and IL-11 levels were higher in Groups II and III indicates the presence of periodontal tissue destruction. Decreases in OSM, LIF and IL-11 levels after the treatment supports that initial periodontal therapy can inhibit periodontal tissue destruction.

0568

**Association Of Periodontal Inflammatory Burden With Salivary MMP-8 Concentration Among Chronic Kidney Disease Patients At Predialysis Stage**

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**Objectives** Our aim was to analyze salivary MMP-8 concentrations with respect to oral/periodontal inflammation in chronic kidney disease (CKD) patients at predialysis stage. We hypothesized that diabetic patients have increased values compared with those of other etiology.

**Methods** This is further research of our cross-sectional, retrospective study of 144 adult predialysis patients (Vesterinen et al. 2011). Clinical and radiographic oral health examinations were made at Helsinki University Hospital (HUCH), Finland. Salivary samples available from 118 of 144 patients were examined for MMP-8 by immune fluorometric assay. Of the patients, 43 (36%) had diabetic nephropathy, while 75 (64%) had other kidney disease. Oral and general health data including laboratory findings, periodontal inflammatory burden index (PIBI), and total dental index (TDI) were recorded from hospital records. Results between groups were analyzed with cross tabulation, Pearson Chi-square test, and Mann-Whitney test.

**Results** Elevated PIBI, increased TDI, and two or more sites with  $\geq 6$  mm periodontal pockets (severe periodontitis) associated with increased salivary MMP-8, ( $p < 0.05$ ). Moderate periodontitis (two or more teeth with  $\geq 5$  mm pocket depth) and bone loss up to apical thirds of root lengths also associated with higher median of MMP-8 concentration ( $\geq 135$  ng/ml), ( $p < 0.05$ ). Diabetic nephropathy group had slightly, but not significantly elevated median salivary MMP-8 concentration (149 ng/ml) compared with other CKD group (116 ng/ml).

**Conclusions** Elevated salivary concentration of MMP-8 associated with more severe markers of oral/periodontal inflammation among the patients but with no significant difference between diabetic vs. other CKD patients. MMP-8 analysis could give adjunctive information of oral health within this special group of patients. Supported by EVO grant TYH2013334 from the HUCH.

0569

### **Chronic periodontitis is not associated with decreased kidney function**

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#### **Objectives**

Chronic kidney disease (CKD) is linked to a high morbidity and mortality worldwide. There is some evidence that periodontitis might also be related to CKD. We aimed to investigate the relationship between these two chronic diseases using data from the Study of Health in Pomerania (SHIP-0).

**Methods** In total, 3332 subjects aged 20-81 years (1639 males) were included. Periodontitis was measured by clinical attachment loss (CAL). Mean CAL and the percentage of sites with CAL3+/4+mm (10% increments) were determined. Glomerular filtration rate (GFR) was calculated according to the MDRD formula and pathological kidney function was defined as GFR <60 mL/min/1.73m<sup>2</sup>. Linear and logistic models were adjusted for age, gender, education, smoking, high alcohol use, last dental visit, interdental care, diabetes, dyslipidemia, obesity and hypertension. Subjects with treated CKD were excluded.

**Results** In linear models, mean CAL was not associated with GFR [B=0.16(95% CI,-0.13;0.44)]. Consistently, no associations were found for percentages of sites with CAL 3+mm [B=0.11(-0.05;0.28)] or the percentage of sites with CAL 4+mm [B=0.12(-0.04;0.29)]. Also, analyses using different parameterizations of periodontal variables using quartiles and the evaluation of dichotomized GFR in logistic models confirmed the previous results (p>>0.05).

**Conclusions** Chronic periodontitis is not significantly associated with kidney function. In contrast to previously published studies, our results suggest that periodontitis may not be an independent risk factor for CKD.

0570

### **Are Periodontitis and Diabetes interacting on all-cause or cardiovascular Mortality?**

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**Objectives** Currently, the evidence on the association between periodontitis and mortality (both all-cause and cardiovascular) is inconsistent. In addition, interaction with diabetes has rarely been addressed. We investigated whether periodontal disease is associated with mortality and if this effect was modified by diabetes.

**Methods** We used data prospectively collected within the population-based study of Health in Pomerania (SHIP) which was conducted in northeastern Germany with baseline examinations conducted from 1997-2001. The final sample comprised 3352 subjects with periodontal examinations, aged 20-81 years. In 11 years of mean follow-up time, 274 deaths occurred, 89 of which were of cardiovascular reasons. Periodontitis was measured using mean CAL (clinical attachment level), extent CAL  $\geq$  3mm and periodontitis score. Periodontitis score is calculated as the average of standardized scores of mean CAL, extent CAL  $\geq$  3mm and number of missing teeth. Cox proportional hazards regression models were run to evaluate the relationship between different periodontal measures, diabetes and mortality, adjusting for age, gender, school education, income, physical activity, BMI, smoking and oral health behavior.

**Results** Mean CAL (HR =1.09; 1.02-1.16), extent CAL  $\geq$  3mm (HR=1.01; 1.001-1.013), number of teeth (HR=0.98; 0.96- 0.99) and periodontitis score (HR= 1.36; 1.09- 1.68) were linearly associated with all-cause mortality. For cardiovascular mortality analysis, after exclusion of subjects with prevalent cardiovascular diseases (heart surgery, myocardial infarction or stroke), HRs were significant for mean CAL (HR= 1.14; 1.00-1.31) and periodontitis score (HR=1.62; 1.02-2.56). We did not find any association between remaining periodontal definitions and cardiovascular mortality. For none of the periodontal measures, multiplicative interaction with diabetes was not found.

**Conclusions** This study confirmed an association between periodontal disease and all-cause or cardiovascular mortality. We did not find an effect modification by diabetes on mortality suggesting that there might not be an increased mortality risk for subjects having both periodontitis and diabetes in this population.

0571

**Impact of estradiol on the dipeptidyl peptidase IV enzyme activity of the *Prevotella intermedia* group bacteria**

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**Objectives** Pregnancy-associated gingivitis has been linked to *Prevotella intermedia* (*sensu lato*), which is able to use estradiol as an alternative source of growth instead of vitamin K. The aim was to investigate *in vitro* the impact of estradiol on the bacterial dipeptidyl peptidase IV (DPPIV) enzyme activity of the *P. intermedia* group bacteria (*P. intermedia*, *P. nigrescens*, *P. pallens*, and *P. aurantiaca*) grown in biofilms.

**Methods** In all experiments, 2 strains of each species were incubated with the concentrations of 0 (control), and 30, 90, and 120 nmol/L of estradiol, representing equivalent serum estradiol concentrations simulating the first, second, and third trimester of pregnancy, and allowed to build biofilms at an air-solid interface. DPPIV activities were measured kinetically during 20 min using a fluorometric assay. The enzyme activity was related to the amount of protein produced by the same biofilm, reflecting the biofilm mass. The experiments were performed in triplicates. **Results** Estradiol significantly increased DPPIV activities of the *Prevotella* strains in a strain- and dose-dependent manner. Enzyme activity peak was reached in the estradiol concentration of 90 nmol/L in 6 strains, while for 1 *P. nigrescens* strain and 1 *P. pallens* strain the peak was reached in the concentration of 30 nmol/L. Dividing the enzyme activity measurements by the total protein mass of biofilms yielded a significant increase in the DPPIV activity in all *Prevotella* strains tested. The *P. aurantiaca* strains had the highest enzyme activities but the lowest biofilm mass.

**Conclusions** Elevated estradiol concentrations enhance the relative and quantitative DPPIV proteolytic enzyme activity in strain- and dose-dependent manners. This may lead to differences between species to elicit a virulent state, which contributes to the development of pregnancy-related gingivitis. The role of *P. aurantiaca* in its pathogenesis deserves attention.

0572

**Periodontal, dentoalveolar, and skeletal effects of tooth-borne and tooth-bone-borne expansion appliances**

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**Objectives** The purposes of this study were to evaluate and compare the periodontal, dentoalveolar, and skeletal effects of tooth-borne and tooth-bone-borne expansion devices using cone-beam computed tomography.

**Methods** Twenty-five patients requiring maxillary expansion were randomly allocated into 2 groups. A tooth-borne hyrax appliance was used in the first group, consisting of 13 patients (8 girls, 5 boys; mean age, 14.3±2.3 years), and a tooth-bone-borne hybrid hyrax appliance was used in the second group of 12 patients (6 girls, 6 boys; mean age, 13.8±2.2 years). Cone-beam computed tomography records were taken before and 3 months after expansion, and periodontal, dentoalveolar, and skeletal measurements were made on the cone-beam computed tomography images with a software program. Independent-samples t tests and chi-square tests were used to evaluate the treatment changes in both groups, and the paired t test ± was used to compare the measurements at 2 time points for the variables.

**Results** Significant skeletal changes and increases in interdental distances were observed in both groups. However, the distances between the first and second premolars increased more with the hyrax appliance (7.5±4.2 and 7.9±3.3 mm, respectively) compared with the hybrid hyrax (3.2±2.6 and 4.5±3.8 mm, respectively) (P<0.05). Similar reductions in buccal bone plate thickness and increases in palatal bone plate thickness of the anchored teeth occurred in both groups, whereas changes in buccal and palatal bone thicknesses of the left first premolars significantly differed between groups (P<0.001). No significant intergroup difference was found in terms of absolute dental tipping.

**Conclusions** Both tooth-borne and tooth-bone-borne rapid expansion are effective methods for treating a narrow maxilla. However, the hyrax appliance resulted in greater expansion in the premolar region. On the other hand, the hybrid hyrax appliance did not cause changes in the bony support of the first premolars.

0573

### **Correlation of Radiographic Dimensions of Gingival Embrasure with Clinical Parameters of Interdental Papilla**

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**Objectives** The level of crestal bone at the interdental area is the most important factor determining the position and dimensions of interdental papilla. The aim of this study is to assess the correlation of the dimensions of gingival embrasures on periapical radiographs with the clinical parameters of interdental papillae.

**Methods** Fifty-six subjects (24 males and 32 females between 20 to 30 years) were evaluated. Five esthetic sites: papillae between the two central incisors, central and lateral incisors and between premolars, were evaluated in each subject. Periapical radiographs were obtained using the parallel technique and an impression was made from the esthetic zone in each subject. The respective embrasures in dental casts were also photographed. The vertical length, base, and surface area of each interdental site were measured both radiographically and clinically. The correlation coefficient between the radiographic and clinical variables was calculated in total and separately for each site. Data were analyzed using SPSS version 19 and the Pearson's correlation test.

**Results** A total of 216 sites were evaluated. The correlation between the heights of clinical papilla and radiographic embrasure was significant only at the embrasure between the two central incisors (0.491,  $P=0.00$ ). The correlations between the clinical and radiographic base and surface area measurements of the papillae were not significant. The correlation between the radiographic embrasure height and clinical base of the papillae was weakly significant only between the central and lateral incisors (0.278,  $P=0.019$ ). The correlation between the radiographic height and clinical surface area of the papillae was also weakly significant (0.278,  $P=0.019$ ).

**Conclusions** The correlations between clinical and radiographic data were not similar in different interdental areas in esthetic zone. It appears that radiographic distance between interdental bone level and contact point had significant correlation with papilla height between two centrals, and weak correlation with papilla width and surface area.

0574

### **Efficacy of Doxycycline Release Collagen Membrane on Contaminated Defects in Rat Tibiae**

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**Objectives** The aim of this study was to investigate the osteogenesis potential and the antibacterial effect of a doxycycline releasing collagen membrane in surgically created and contaminated defects in rat tibiae.

**Methods** Defects were created in 30 rats that were randomly divided into five groups: Control group 1; Control group 2 (defect contaminated by *Porphyromonas gingivalis*; Xenograft group (defect contaminated by *P. Gingivalis* and filled with bone graft); Pancoll group (defect contaminated by *P. Gingivalis*, filled with bone graft and covered by Pancoll); Doxycoll group (defect contaminated by *P. Gingivalis* filled with bone graft and covered by Doxycoll). Animals were sacrificed post surgically on the 14<sup>th</sup> day for microbiologic evaluation and on the 28<sup>th</sup> day for histopathological evaluation. The Kruskal Wallis test was used for comparing different parameters between the groups. The Mann Whitney U test was used for post hoc determinations. The chi-square test was used to compare qualitative data. The significance level was set at  $p<0.05$ .

**Results** The degree of osteogenesis in the Doxycoll group ( $1.80\pm0.45$ ) was found to be significantly higher than that of the Pancoll group ( $0.33\pm0.52$ ) ( $p:0.007$ ;  $p<0.01$ ). Furthermore, the lowest bacterial count ( $3\times10^4$  CFU) was observed in the Doxycoll group compared to all other groups.

**Conclusions** Within the limitations of this study, Doxycoll could be a favourable material for the enhancement of bone formation and limiting *P. Gingivalis* infections following GBR procedures in a rat model.

0575

**Changes of serum levels of intracellular enzymes during occlusal trauma**

**Dilsiz, A., Sevinç, S., Günay, A., Karaçam, K.**

**Atatürk University**

**Objectives** The aim of the study was to investigate changes of the serum levels of enzymes such as ALP, AST, ALT, CK, and LDH during experimental occlusal trauma in rabbit.

**Methods** 20 New Zealand White male rabbits were selected and divided into two groups. Experimental periodontitis was induced by tying a silk ligature around the neck of mandibular anterior teeth of rabbits in each group. Clinical indices and radiographic examinations were carried out on experimental days 0, 7, 21 and 90. In group test, experimental occlusal trauma was produced in the animal's lower anterior teeth by insertion of metal crowns, which raised the vertical dimension of occlusion by 2 mm and incorporated interferences into the occlusion. Blood samples were taken 0, 1, 3, 7, 30, or 90 days after the introduction of occlusal trauma, and the serum levels of enzymes such as ALP, AST, ALT, CK, and LDH were measured by ELISA.

**Results** At day 3 after insertion of the crowns there was a significant decrease of serum ALP level ( $p < 0.05$ ).

Furthermore, there was evidence of trauma from occlusion of the experimental teeth, including a significant increase of tooth mobility, crown fracture, and occlusal wear; radiographically there were signs of breakdown of marginal and interradicular alveolar bone, PDL space widened and root resorption. Statistically significant correlations were not observed between levels of enzymes and periodontal clinical parameters.

**Conclusions** Determination of blood levels of enzymes may be appropriate method to evaluate periodontal tissue damage. Analysis of intracellular enzymes seems to be more beneficial.

0576

**Micro-morphological Changes Of Various CAD-CAM Blocks After Different Surface Treatments**

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**Objectives** To evaluate the effect of different surface treatments on the micro-morphological structure of 6 different CAD-CAM blocks.

**Methods** Each CAD-CAM block (Celtra Duo, Dentsply; IPS Empress CAD and IPS e.max CAD, Ivoclar Vivadent; Lava Ultimate, 3M ESPE; Vita Enamic and Vita Mark II, VITA Zahnfabrik) was sectioned with a diamond blade to produce rectangular micro-bars. They were randomly divided into 3 groups and were treated either with SiC paper (600-grit, Buehler), sandblasted using 27- $\mu$ m Al<sub>2</sub>O<sub>3</sub> (Danville), or subjected to tribochemical silica coating (30- $\mu$ m CoJet, 3M ESPE). Subsequent treatments involved either etching with 5% hydrofluoric acid (HF; IPS Ceramic Etching Gel, Ivoclar Vivadent) during 60 sec for all CAD-CAM blocks except for IPS e.max CAD (20 sec) and Celtra Duo (30 sec), silanization using a universal ceramic primer (Monobond Plus, Ivoclar Vivadent) applied for 60 sec, etching with HF followed by silanization, or no further treatment (control). All treated specimens were processed for scanning electron microscopy (SEM; JSM 6610LV, JEOL).

**Results** SEM revealed different surface topographies. The surfaces appeared relatively smooth after polishing with SiC paper. The surface topography after sandblasting exhibited shallow irregularities. Tribochemical silica coating resulted in smoother surfaces with silica particles deposited onto the surface. HF etching had a very aggressive effect on the surface of all CAD-CAM blocks regardless of the other conducted treatments: bean-like crystals (Celtra Duo); honey comb-like irregularities (IPS Empress CAD); elongated crystals (IPS e.max CAD); resin matrix with embedded nano-particles (Lava Ultimate, Vita Enamic); irregular ceramic particles (Vita Mark II). Silanization slightly modified the basic topography obtained with previous treatments; it only became smoother.

**Conclusions** The surface micro-morphology of different CAD-CAM blocks depends on the ceramic composition and different surface treatments, with the greatest impact resulting from HF etching.

0577

# **New Self-Etching Glass-Ceramic Primer: Innovative Alternative for Glass-Ceramic Conditioning**

Catel, D., Koch, S., Lanz, C., Bock, T.

Ivoclar Vivadent AG

**Objectives** The clinically recognized procedure to achieve a strong and durable bond to glass-ceramics involves HF-etching & silanization. Silanization is responsible for chemical bond formation, while HF-etching creates micromechanical interlocking. However, HF poses handling issues due to its toxicity and capacity to over-etch glass-ceramics, requiring the development of less toxic and aggressive alternatives. Although HF-substitutes have been already reported in the literature, HF-etching remains the gold-standard for glass-ceramic conditioning.

To overcome HF-etching drawbacks, a self-etching glass-ceramic primer (Monobond Etch&Prime/MBEP/Ivoclar-Vivadent), combining a HF-free etchant and silane-system, was developed. This new HF-free-system is able to etch & prime all commercial glass-ceramics in a single step and application-procedure.

This study investigates MBEP-etching & -bonding performances to commercial glass-ceramics using scanning-electron-microscopy (SEM) and tensile-bond-strength (TBS).

**Methods** The following glass-ceramics were selected: lithium-disilicate & leucite (e.maxCAD & EmpressCAD/Ivoclar-Vivadent), lithium-metasilicate (Celtra/Dentsply), feldspar (MarkII/Vita).

Glass-ceramics were allocated into two groups regarding surface-treatment. Group 1 (HF/MBP) was used as reference: the surface was treated with hydrofluoric acid (HF/application-time according to ceramic-IFU/5%HF-gel/Ivoclar-Vivadent) followed by Monobond Plus (MBP for 60s/Ivoclar-Vivadent). Group 2 (MBEP) was treated with Monobond Etch&Prime (MBEP for 60s/Ivoclar-Vivadent). TBS was investigated with Multilink Automix and Variolink EstheticDC (MLAM & VE, Ivoclar-Vivadent). Two different aging-procedures were tested: 24h@37°C and 10'000 thermocycles (10kTC/5-55°C/30s). Morphology of etched surfaces was examined by SEM.

**Results** For results see the table below.

MBEP- and HF/MBP-groups demonstrated comparable TBS-values to all tested glass-ceramics.

SEM revealed that MBEP generates a less pronounced etch-pattern than HF.

**Conclusions** MBEP showed comparable bonding performances to the well-established-system HF/MBP. This new HF-free-system allows conditioning of all commercial glass-ceramics in a simple & safe application-procedure.

Treatment	Cement	TBS/24h@37°C[MPa]			
		e.maxCAD	EmpressCAD		
HF/MBP	VE	42.1±7.1 <sup>a</sup>	49.3±6.1 <sup>b</sup>		
MBEP		42.5±7.2 <sup>a</sup>	47.5±9.9 <sup>b</sup>		
HF/MBP	MLAM	59.6±5.5 <sup>a</sup>	44.3±6.0 <sup>b</sup>		
MBEP		51.1±9.3 <sup>a</sup>	55.7±5.2 <sup>b</sup>		
Treatment	Cement	TBS/10kTC/5-55°C[MPa]			
		e.maxCAD	EmpressCAD	Celtra	MarkII
HF/MBP	VE	35.1±11.5 <sup>c</sup>	31.4±3.8 <sup>d</sup>	38.4±6.9 <sup>e</sup>	39.7±8.8 <sup>f</sup>
MBEP		47.9±6.6 <sup>c</sup>	31.5±5.9 <sup>d</sup>	35.1±10.1 <sup>e</sup>	32.5±12.4 <sup>f</sup>

Same letter per column means statistically equivalence (p<0.05/ANOVA/Tukey-Post-Hoc-Test).



0578

# **Self-Etching Glass-Ceramic Primer vs. Universal Adhesives: Bond Strength to Lithium-Disilicate**

Koch, S., Catel, D., Bock, T.

Ivoclar Vivadent

**Objectives** The established standard technique to prepare glass-ceramic restorations for adhesive cementation recommends hydrofluoric acid (HF) etching prior to silanization. To eliminate the use of potentially toxic HF, a new HF-free self-etching glass-ceramic primer, Monobond Etch&Prime (MBEP), was developed to etch and prime glass-ceramics in one step.

This study compares bond-strength to lithium-disilicate (LD2; e.maxCAD, Ivoclar-Vivadent) of MBEP to a state-of-the-art ceramic primer and several universal adhesives.

**Methods** Shear bond strength (SBS, N=5) to LD2 was investigated using the following material combinations.

Group: Etchant; Primer/Adhesives; Cement; Manufacturer

MBEP: No HF; Monobond Etch&Prime ; Multilink Automix; Ivoclar Vivadent

MBP: 5% HF; Monobond Plus; Multilink Automix; Ivoclar Vivadent

OXTR: 5% HF; Optibond XTR; NX-3; Kerr

ABU: 5% HF; AllBond Universal; DuoLink; BISCO

SBU: 5% HF; Scotchbond Universal; Relyx Ultimate; 3M ESPE

LD2-surfaces were wet-ground followed by HF-etching (20s, 5%HF) for all groups, except for MBEP, which does not require HF-etching. Prepared surfaces were then treated with either a primer or an universal adhesive according to manufacturer's instructions. Afterwards the system-cement was applied in a single increment using an Ultradent-SBS-jig. Samples were light-cured for 20sec or 40sec for OXTR (Bluephase-Style, 1200mW/cm<sup>2</sup>, Ivoclar-Vivadent) and stored in water for 24h@37°C or thermocycled 10'000-times at 5-55°C (30sec dwell-time; 10'000TC).

**Results** For results see table below.

Initial SBS (24h) of MBEP to LD2 was significantly higher than all other groups tested, whereby the SBS values of universal adhesives were lower than MBP & MBEP. Exposure of these samples to aging (TC) showed to a similar trend (MBEP = MBP ≥ SBU > AU >OXTR). Moreover, pre-test-failures for OXTR were observed.

**Conclusions** MBEP offers a promising HF-free alternative to the commonly combination of HF & primer or HF & universal adhesives, ensuring high bond-strength and bond longevity.

## **Results**

	SBS [MPa]				
	MBEP	MBP	OXTR	ABU	SBU
<b>24h@37°C</b>	51.2±3.7 <sup>a</sup>	33.4±6.0 <sup>b</sup>	19.6±7.6 <sup>c</sup>	20.2±2.5 <sup>c</sup>	25.0±5.3 <sup>b,c</sup>
<b>10'000TC</b>	26.9±6.9 <sup>a'</sup>	24.3±4.8 <sup>a',b'</sup>	0.6±1.4 <sup>c'</sup>	4.9±1.4 <sup>c'</sup>	18.5±3.7 <sup>b'</sup>

Same letters denominate statistical equivalence in rows (ANOVA, Tukey, p<0.05).

0579

# Characteristics of polymer based CAD/CAM Blocks for permanent restorations

Böhner, R., Claude, M., Kopfmann, C.

Coltene AG

**Objectives** Analysis of hybrid and polymer based CAD/CAM blocks with respect to mechanical strength, water uptake and filler load.

**Methods** As reference concerning mechanical strength and modulus of elasticity a Leucite ceramic, IPS Empress CAD (IPS, Ivoclar Vivadent) was selected. For a hybrid material Vita Enamic (VE, Vita Zahnfabrik) and as polymer based materials Lava Ultimate (LU, 3M Espe), Coltene Experimental (CEX, Coltene AG), Cerasmart (CS, GC Corporation) and HC (HC, Shofu) were selected. The samples were cut with an Isomet 1000 diamond saw from 14L sized blocks.

**Flexural strength and modulus of elasticity:** Sticks with a dimension of 1x1x18mm were prepared. The sticks were stored in water for 24h at 37 °C. After storage a three point bending test (Zwick Z020, crosshead speed 0.5mm/min, span width 10 mm, n=7) was done. Flexural strength and modulus of elasticity was determined. Water uptake was done with discs (discs from block size 14L, thickness 1mm, n=5), according to ISO 4049. Data were analyzed with a one way ANOVA (p<0.05)

**Filler content** was determined (n= 3) by burning the organic components at a temperature of 700°C in the presence of air.

**Results** Polymer based materials show an elasticity comparable or lower than human tooth structure. Flexural strength varies from 140 (VE) to 198 (CEX).

**Conclusions** Polymer based composite blocks for permanent restorations show equal or better mechanical strength than an established Leucite ceramic. Low modulus of elasticity could be a benefit for a full crown on tooth or implant. The water uptake of HC fulfills the ISO 4049 requirements, but seems to be very high for an Inlay preparation. Further investigations have to prove whether restorations made from polymer based CAD/CAM blocks are an alternative to ceramics.

## Properties of CAD/CAM Materials

Material	Flexural strength / MPa	Modulus of elasticity / GPa	Water uptake / µg mm <sup>-3</sup>	Filler weight / weight%
VE	140 ±10 c	28.6 ±1.3 b	8.4 ±0.7 a	86.8 ±0.0
LU	167 ±12 b	12.9 ±0.4 c	29.2 ±1.2 d	71.9 ±0.1
CEX	198 ±14 a	10.3 ±0.5 d	19.5 ±0.4 b	70.7 ±0.3
CS	160 ±12 b	8.3 ±0.3 e	21.0 ±0.4 c	64.1 ±0.0
HC	121 ±4 d	7.7 ±0.6 f	39.6 ±0.6 e	61.4 ±0.1
IPS	162 ±29 b	56.9 ±6.8 a	not applied	not applied

0580

# Effects of different finishing and polishing procedures on color of a novel hybrid ceramic material

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**Objectives** Hybrid ceramic materials appear to be promising for single crowns, implant supported single crowns and intracoronal restorations since they present lesser antagonistic tooth wear, marginal and integral adaptation results that are better than those of feldspathic ceramic. VITA Enamic is one of the novel hybrid ceramic materials in the dental market. The producer of the material suggests different finishing and polishing procedures for VITA Enamic. Thus, the objective of the present study was investigation of color changes caused from different finishing and polishing procedures of VITA Enamic which is a new hybrid ceramic material combining the positive features of a ceramic and a composite.

**Methods** 90 specimens were prepared 2x10x12 mm diameters from high translucency (HT) and translucency (T) 2M2 shade VITA Enamic blocks. The specimens were divided into 6 groups. For each of the groups, different finishing and polishing procedures, including VITA Enamic technical kit, clinical kit and glaze, were performed. Color changes were evaluated using by a clinical spectrophotometer. The data was analyzed using one-way

ANOVA and Tukey's post-hoc comparison. The significance level was set at  $\alpha=0.05$ .

**Results** There was statistically no difference between technical kit HT, technical kit T and clinical kit T groups ( $p>0.05$ ). There was statistically difference between the clinical kit applied HT group, glaze applied HT group and glaze applied T group ( $p<0.05$ ). The most shade difference, before finishing and after finishing, was observed clinical kit applied HT group. In the dental literature, the acceptable color difference threshold was taken as 2.36 for  $\Delta E_{00}$ . Except the clinical kit applied HT group, all of the finishing and polishing techniques showed clinically acceptable color difference.

**Conclusions** In the limitations of the present study, it may be suggested that finishing and polishing VITA Enamic restorations with the technical kit to have a minimal color difference between the selected color and the final stage of the restorations.

Mean and standard deviation for  $\Delta E_{00}$

Groups	Means	Standard Deviations	
Group 1	0,50	0,18	a
Group 2	2,32	0,37	d
Group 3	1,35	0,17	c
Group 4	0,39	0,21	a
Group 5	0,61	0,24	a
Group 6	0,95	0,40	b

## 0581

### Shear Bond Strength Of The Intraoral Repair Systems To New Cad/Cam Materials

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**Objectives** This study evaluated the shear bond strengths (SBS) of two intraoral repair systems on four commercially available CAD/CAM materials.

**Methods** CAD/CAM blocks were sectioned with 2.5 mm thickness. Aged specimens (IPS e.max CAD, Vita Suprinity, Vita Enamic and Lava Ultimate; 5000 cycles, 5°-55 °C; n=80) were randomly divided into two groups according to the repair system: Ivoclar Repair Kit (37 % phosphoric acid + Monobond S + Heliobond + Tetric N Ceram) and Clearfil Repair System (40 % phosphoric acid + mixture of Clearfil Porcelain Bond Activator and Clearfil SE Bond Primer + Clearfil SE Bond + Filtek Z250). Resin composite was photo-polymerized on conditioned specimens. Each specimen was stored in distilled water at 37 °C for 24 h and then additionally aged for 5000 thermal cycles between 5 and 55 °C. The SBS was tested using a universal testing machine (0.5 mm/min). Two-way ANOVA was used to detect significance difference according to CAD/CAM material and intraoral repair system factors. Subgroup analyses were done by LSD post-hoc test.

**Results** The results of two-way ANOVA indicated that SBS values varied significantly depending on restorative materials and intraoral repair systems ( $p<0.05$ ). There were no significant differences between the SBS of two intraoral repair systems with CAD/CAM materials ( $p<0.05$ ), except VS groups ( $p>0.05$ ).

**Conclusions** Highest bond strength values were observed in resin nano ceramic and dental hybrid ceramic blocks.

0583

# **Influence of different indirect composite materials and cavity preparation design on the fracture resistance of MOD inlay restoration**

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**Objectives** Evaluate the fracture resistance of indirect composite materials on the three different MOD inlay cavity designs.

**Methods** 80 mandibular third molar selected and divided into 4 groups. (1) intact teeth as control group, (2) non-proximal box, (3) 2mm proximal box, (4) 4mm proximal box. Each cavity design received two different indirect composite materials: Estenia (Kuraray) or Epricord (Kuraray) (n=8). The inlay restorations were adhesively cemented with dual cure resin cement (Panavia, Kuraray, Japan). After storing 24h distilled water, specimens were subjected to a compressive load until fracture at a crosshead speed of 0.5mm/min. Statistical analysis was performed using the One Way analysis of variance and Tukey Post Hoc Test (p<0.05).

**Results** The highest fracture strength values were obtained from non-proximal box cavity design (significantly, 3060.1±654.8); it was followed by 2mm proximal box (2033.7±356.4) and 4 mm proximal box (1564±635.1) for Estenia. There was no significant difference between three inlay cavity design for Epricord (2150.3±553.4; 2191.6±642.3; 2006.9±531.5 respectively, (p>0.05)). Estenia exhibited significantly higher fracture strength than Epricord only for the non-proximal cavity design (p<0.05). The fracture strength values of non-proximal box cavity design inlays restored with Estenia and 2mm proximal box cavity design inlays restored with Epricord were similar to those of the intact teeth (2805.2±640.7).

**Conclusions** Using a non-proximal box design for the cavity may further improve the fracture resistance of the inlay restoration. The fracture strength of indirect composites can show variability according to the design of the cavity.

The fracture resistance of indirect composite materials on the three different MOD inlay cavity designs.

Indirect composite type	Non-proximal box	2 mm proximal box	4mm proximal box
Estenia (Kuraray, Japan)	3060.1±654.8 Aa	2033.7±356.4 Xb	1564±635.1 Yb
Epricord (Kuraray, Japan)	2150.3±553.4 Ba	2191.6±642.3 Xa	2006.9±531.5 Ya
Intact teeth	2805.2±640.7		

0584

#### **MYOSITIS OSSIFICANS TRAUMATICA OF THE MEDIAL PTERYGOID: A RARE CASE REPORT**

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**Objectives** Traumatic myositis ossificans (MOT) is heterotopic bone formation within a muscle due to a single or repetitive injury. It is a rare clinical entity and only 9 cases of isolated unilateral medial pterygoid muscle have been reported in the literature. We report a case of isolated unilateral medial pterygoid muscle in 33-year-old male. **Methods** The maximum mouth opening (MMO) was 16 mm with an almost complete absence of any protrusive, right and left mandibular movements. Past dental history revealed that the patient was underwent arthrocentesis and physiotherapy by diagnosing disc displacement without reduction. A CT scan showed a formation of a bone mass into the right medial pterygoid muscle extending medially to lateral pterygoid plate. The working diagnosis was MOT of the right medial pterygoid muscle. Treatment consisted of surgical excision of the bony formation throughout an intraoral approach and aggressive postoperative jaw physiotherapy.

**Results** Histopathology confirmed MOT that it showed bone tissue with numerous lacunae filled with osteocytes and the area of mature osteoid woven, cartilage and collagen fibers. The patient had improved the range of motion of the mandible, reaching a MMO of 30mm. Postoperative CT scan showed the bony discontinuity between muscle and lateral pteryoid plate. The patient continues to be followed up regularly.

**Conclusions** The unusual and rare site of MO in the presented case caused delay, making a correct diagnosis. The only treatment modality is complete excision of the ossified mass as early as possible followed by aggressive postoperative physiotherapy if the patient has pain and restricted mouth opening.

0586

#### **Stafne bone defect at coronoid region: An unusual case**

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**Objectives** The aim of this presentation is to report the stafne bone defect in coronoid region.

**Methods** A 38 year old female referred to us with a complaint of pain due to dental caries. She has no systemic disease. A routine orthopantomograph showed a well-defined radiolucent lesion with radio-opaque border at the right coronoid process incidentally. In cone beam computerized tomography, a radiolucent lesion with well demarcated radio-opaque border was seen in coronoid region clearly. There were no signs or symptoms about the lesion clinically.

**Results** The lesion was considered as stafne bone defect because of radiographic image and asymptomatic nature.

**Conclusions** There was no reported stafne bone defect case in this region in the literature. As a conclusion, routine panoramic radiographic examination is crucial in dentistry.

0587

#### **Rehabilitation Of Maxillary Resections With Hollow Bulb Obturator: A 2-Case Report**

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**Objectives** Maxillary resections usually performed for tumoral reasons could cause significant psychological problems in patients in addition to aesthetic, phonation and functional problems. In these situations, the defect is attempted to be confined surgically, but it is not possible in all cases. In cases where surgical intervention is insufficient or not even possible, prosthetic obturation of the defect is necessary. This article provides information on the hollow bulb obturators and their construction stages in two patients that underwent hemi-maxillectomy due to adenocystic carcinoma and epidermoid carcinoma.

**Methods** The patients diagnosed with adenocystic carcinoma and epidermoid carcinoma were sent to the consultant doctor by Ear Nose Throat. Models and photographs were taken before operation, surgical obturators were fabricated for the surgical areas provided and the patients were fed without the need to use the nasogastric probe.

**Results** Hollow bulb obturator was applied to the patients within the 3 months following the operation.

**Conclusions** The lack of anatomical structures to provide adequate support and retention for prothesis in patients with partial resection of maxillary is one of the biggest problems encountered during obturator prothesis fabricating.

0588

**Bilateral fusion: report of a rare case**

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**Objectives** Dental abnormalities result from disturbances during morpho-differentiation stage of tooth development. Fusion is one of these dental abnormalities characterized by the union of two or more adjacent teeth. The aim of the present study was to report a case with fusion of mandibular incisors.

**Methods** This article represents a 19 year-old female patient with bilaterally fused permanent mandibular central and lateral incisors which were detected in routine dental examination.

**Results** In clinical examination, there were no symptom on fused teeth. Besides, no caries lesion or periapical pathology were detected on radiographs examined. The patient was referred to prosthodontics to provide esthetics and dental hygiene.

**Conclusions** Physicians must be aware of these abnormalities to prevent further complications, such as cleaning difficulties, esthetic problems, caries lesions and periapical pathologies.

0589

**Orthodontic and orthognathic treatment of a skeletally Class II patient-Case Report**

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<sup>1</sup>Yeditepe University Dental Faculty, <sup>2</sup>Private practice

**Objectives** This case report presents the orthodontic and orthognathic treatment approach of an adult patient with skeletal Class II and maxillary transverse deficiency.

**Methods** 22-year old female patient referred to our clinic with the chief complaint of retrognathic mandible. The patient had convex profile and vertically normal growth pattern, sagittally Class II with bimaxillary retrognathia. There was 4 mm of transverse deficiency between the upper first premolars and 3 mm of gummy smile at the incisor region. There was 10 mm of overjet, 4 mm overbite; 6 mm of crowding on the maxilla and 7 mm crowding on the mandible. After these evaluations orthodontic and orthognathic surgery has been decided as a treatment approach. The spaces of the extracted first premolars were closed by moderate anchorage. After alignment and decompensation, the 0.19"x0.25" stainless steel arch wire was separated from distal of lateral teeth to 3 segments. The mandible was 12 mm forward positioned and maxilla was 3 mm forward positioned. By the three-piece surgery of the maxilla the transversal dimension between the upper 1st premolars were widened. Upper incisor edge was moved upwards 3 mm and mesio-buccal surface of the 2nd molars was moved downwards about 2 mm. Miniplates were used for fixation of the jaws. Total treatment duration was 2 years.

**Results** There was an evident improvement on hard and soft tissues and the occlusal situation.

**Conclusions** The orthodontic and orthognathic treatment of skeletally Class II patient was successful. Intra-oral functional and extra-oral esthetical situation were stable.

0590

***Squamous cell carcinoma of the oropharynx in a HPV infected patient***

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**Objectives** Squamous cell carcinomas, especially ones located within the head and neck, are one of the most frequent neoplasms in Poland. A case of a patient with a highly oncogenic HPV virus type detected and concurrent squamous cell carcinoma of the oropharynx is presented.

**Methods** A patient was admitted due to oropharyngeal cancer. He presented very poor state of dentition. An orthopantomogram and HPV commercial diagnostic test developed by Nucleagena was taken. Histopathologic examination was done.

The 53-year-old was on his last dental check-up 20 years earlier. He had been abusing alcohol and smoking one pack of cigarettes daily on average since he was 20. Frequency of accidental contacts with women without protection was quite high. He had worked in the printing industry for 30 years, he had been exposed to many quite strong substances

**Results**

The examination revealed highly oncogenic HPV type 35, 38,500 copies of viral DNA were detected, which corresponds with 10,000 HPV DNA copies / 1 µg of DNA isolated from the sample. Qualitative examination with genotyping was performed with use of PCR and RFLP. Quantitative RT-PCR examination was characteristic of the following sensitivity: 1000 virus copies / 1 µg of DNA of material sampled from tumour.

The combined radiochemotherapy scheme resulted in full regression of lesions in the oropharynx on the right side

and partial regression by about 70% of lymph node packages of the neck on the right side. After the treatment had been completed, fibrin coatings were observed. Persistent pain during swallowing subsided. The patient was discharged in good general condition

**Conclusions** Alcohol abuse, smoking cigarette, poor oral hygiene, HPV infection have a significant impact on occurrence of a neoplasm in human population. The patient was exposed to all of these factors. In the case presented squamous cell carcinoma was diagnosed.

**0592**

**Acute Necrotizing Ulserative Gingivitis: A Case Report**

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**Objectives** Necrotizing ulcerative gingivitis (NUG) is rarely infectious disease of the gum, which is characterized by ulceration and necrosis of the interdental papillae. NUG diagnosis is based on three spesific symptoms: pain, necrosis of the interdental papillae and bleeding. It is associated with immune dysfunction, poor oral hygiene, emotional stress, smoking. The aim of this report is to present a case of ANUG at the upper anterior region of a 35-year-old male patient.

**Methods** A-35-year-old male patient referred to our clinic with complaints bleeding, pain and halitosis that were present for 3 weeks. He was a heavy smoker, had a stressful life for last 2 months and was a systemically healthy.

**Results** Clinical periodontal examination showed classic symptoms of the NUG. Non surgical periodontal treatment of the NUG was revealed with systemic metronidazole administration in addition the scaling and root planning. Hydrogen peroxide rinse was also used. After 1 months, surgical correction of the plaque retentive gingival counters was performed.

**Conclusions** Although NUG cases are usually associated with various immun deficiencies, lifestyle which includes heavy smoking and emotional stress may rarely cause this disease at systemically healthy patients.

**0593**

**A Multidisciplinary Approach for the Management of a Pathological Tooth Migration**

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**Objectives** The physiological tooth position is determined by interactions between periodontal tissue and lip, tongue and masticatory forces. Disturbance of those balances might lead to pathological tooth migration which often requires multidisciplinary treatment approaches. This case demonstrates a single visit restorative-periodontal treatment of a pathological migration due to chronic periodontitis and a prominent labial frenum.

**Methods** 46-year-old male patient was initially subjected to phase-I periodontal treatment. A fiber reinforced bridge with direct composite build-up were applied to the mandibular midline diastema comprising an extra incisor. Following the restorative procedure, frenectomy was performed with simple excision technique. Sutures were removed 1 week postoperatively and patient was recalled 6 months later.

**Results** The restoration was still satisfying the patient with its good function, esthetics and durability after six months. Patient's oral hygiene level was improved. Frenum attachment did not extent over the alveolar crest and free gingival margin was not mobile.

**Conclusions** This report describes a rapid, conservative, cost effective and reliable treatment option of pathological migration. As well as the adhesive technique, adaptation and retention of fiber net, it's important to eliminate the etiologic factors such as prominent frenum and chronic periodontitis.

0594

### **Titanium Prepared Platelet Rich Fibrin Combined with Enamel Matrix Derivative in the Treatment of Periodontal Intraosseous Defect: A Case Report**

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**Objectives** We developed a new product called titanium-prepared platelet-rich fibrin (T-PRF). The fibrin carpet formed in T-PRF have a firmer network structure, and longer resorption time in the tissue than the fibrin carpet formed in platelet rich fibrin activated in glass tube. T-PRF, a rich source of autologous growth factors and cytokines, is becoming an important therapeutic approach in the management of periodontal osseous defects. Today in the clinical practices both in periodontal osseous and mucogingival surgeries the most widely used biological factor is the Enamel Matrix Derivative (EMD). The aim of this case report is to present the management of an intrabony osseous defect with T-PRF& EMD with clinical and radiographic evaluations.

**Methods** A 45 year-old systemically healthy female patient is presented with an intrabony periodontal defect in relation to the mandibular first molar. Digital radiographic analysis revealed angular bone loss in the region. The defect had probing pocket depths (PPD) of 9 mm and loss of clinical attachment level (CAL) was treated by the use of T-PRF combined with EMD. Clinical and radiographic parameters were recorded at baseline and at 12 months post-operatively.

**Results** Twelve months follow up revealed a significant reduction in PPD and CAL gain. At the end of 12 months as well as radiographic bone formation was observed.

**Conclusions** The present results of this report suggest that treatment of deep intrabony periodontal defects by the use of T-PRF and EMD combination provides a rapid, effective and safe grafting modality.

0596

### **The platelet-rich fibrin (PRF) with xenograft in the treatment of periodontal intra-bony defect.**

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**Objectives** Periodontal disease is marked by prolonged inflammation of the periodontal tissues resulting in attachment loss, gingival recession and alveolar bone resorption. The fundamental objective of periodontal therapy is regeneration of the lost periodontal tissues. The aim of this case report; to investigate the clinical and radiological (bone fill) effectiveness of PRF with the use of xenograft in the treatment of intra-bony defect..

**Methods** 40-year-old patient had generalized had chronic periodontitis without any systemic disease. Radiographic evaluation revealed a vertical defect on the right mandibular canine requiring open flap debridement with regenerative methods. The teeth numbered #43 disto-vestibule and disto-lingual values; for periodontal pocket depth (PPD) was 7 mm and 5 mm, for gingival recession (GR) 5 mm and 1 mm, respectively. Careful instructions on proper oral hygiene measures was given and scaling+ root planning was performed. After phase 1 therapy; the area was treated with open flap debridement. The defect was filled with xenograft material and PRF membrane was covered on the graft. 3 months later, additional free gingival graft was applied on that region due to absence of keratinized tissue. Postoperative results showed uneventful wound healing without any complications after 1 year. The site presented with a significantly clinical attachment gain; disto-vestibule: 6 mm and disto-lingual: 3 mm In addition, periapical radiography revealed bone fill in that area and keratinized tissue gain was 6 mm on the vestibule side of the #43.

**Results** Vertical bone defects are successfully treated with graft materials and PRF is a promising membrane substitute. In addition, muco-gingival operations are performed to support the keratinized tissue if needed.

**Conclusions** When combined with lack of keratinized tissue, periodontal bone defects worsen rapidly. In order to succeed, immediate treatment must be performed and further studies are required to prove the effectiveness of PRF as a regenerative material in the treatment of periodontal intrabony defects.



0597

### **Horizontal Root Fracture Treated by Intentional Replantation**

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**Objectives** Treatment alternatives for root fractures depend on the fracture location and may contain treatment methods such as surgical or orthodontic extrusion, intentional replantation, periodontal surgery and extraction. Tooth with horizontal root fracture is usually needed extraction because of the difficulties of restoration. In this case report, we tried to treat a horizontal root fracture with combination of root restoration and intentional replantation.

**Methods** A 55 years old female patient was referred to our clinic with advanced bone loss and a horizontal root fracture in the apical third of #31. Firstly, the phase I periodontal treatment was done and an appointment was given for surgical treatment. Under local anesthesia flap was elevated, the fractured segments of the teeth were extracted deliberately, then inflamed granulation tissues in root surface were removed using curettes. All fragments were soaked in physiological saline solution. Later, fragments of root were prepared with endodontic rotary instruments separately. Apical fragment's canal filling was completed using gutta percha points and resin-based canal sealer. A fiber post was applied 3 mm away from apex, and remaining canal filling was removed as necessary for the placement of the post. After scaling and root planning, the extraction socket was gently curetted to remove debris. The tooth was replanted into its original position and stabilized to adjacent teeth by composite resin temporarily. One month later, free gingival graft and vestibuloplasty operation performed because of inadequate keratinized gingiva. Finally, following four month, intracoronal fiber splint applied permanently.

**Results** The patient has been maintained for two years and there is no inflammation, attachment loss and complication in fracture area.

**Conclusions** Generally, treatment of horizontal root fracture associated with advanced bone loss is resulted with extraction. But, in this case, we treated a horizontal root fracture with combination of root restoration and intentional replantation with any complication.

0598

### **Adjunctive Usage Of Low-Level Laser Therapy For Necrotizing Ulserative Gingivitis**

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**Objectives** Necrotizing ulcerative gingivitis (NUG) is unique among the periodontal diseases with distinctive characteristics of rapid onset of gingival pain, interdental gingival necrosis as often described by "punched out" ulcerated papillae and bleeding. NUG is limited to lesion involving gingival tissue with no loss of periodontal attachment and bone loss. Interproximal gingival necrosis is easy to detect. The onset of NUG is associated with increased psychological stress and decreased nutrient intake.

**Methods** 17 years old women was referred to the Department of Periodontology, Abant Izzet Baysal University Faculty of Dentistry with severe pain in gingival tissues. Patient has stressful because of exams and doesn't have systemic problem. Intra-oral examination localized necrotic tissues were seen bilateral maxiller premolar interproximal region and there is continuous involuntary physical trauma inflicted by patient's nails. In the first session only polishing and attouchement with ½ diluted 3% hydrogen peroxide were performed. Following our patient some relief, phase I periodontal treatment was applied. For pain-reducing and promoting wound healing we used low level laser theray (1W, CW mod). After healing of the necrotic tissues muscle attachments were excised and vestibul sulcus was deepened using diode laser in premolar area. Periodontal dressing was applied for one week.

**Results** Patient were seen every week for 1 month. Healing was uneventful. There was no need to used painkiller when using laser and patient's bad habits disappeared.

**Conclusions** Clinical signs and symptoms of NUG will usually resolve within a few days after receiving adequate treatment; however, patients remain at risk for recurrences of disease. Within the limit of this case, low level laser therapy is a succesful treatment modality for wound healing process and reducing gingival pain in NUG patients. Also high muscle attachments should be excised for adequate vestibul sulcus depth so that patients can carry out proper oral hygiene especially NUG.

**Can We Treat Peri-Implantitis? A Case Report With 1 Year Follow Up**Coskuner, S.<sup>1</sup>, Paksoy, T.<sup>1</sup>, Yavuz, T.<sup>2</sup>, Duran, I.<sup>1</sup><sup>1</sup>Abant Izzet Baysal University Faculty of Dentistry, <sup>2</sup>Abant Izzet Baysal University Faculty of Dentistry

**Objectives** Peri-implantitis was defined as an inflammatory process around an osseointegrated implant in function, resulting in loss of supporting bone. Several approaches have been proposed to treat peri-implantitis, including mechanical debridement, antimicrobial therapy and resective or regenerative surgical therapy. This case report highlights that peri-implant treatment can be achieved successfully via nonsurgical therapy.

**Methods** Fifty-seven years old systemically healthy non-smoker male was referred to the Department of Periodontology, Abant Izzet Baysal University from a special clinic with complaint of pain, bleeding of gums, supuration around implants and bad breath. Clinical and radiological examination revealed as peri-implantitis in mandibular anterior region (probing pocket depth (PPD) >7 mm with supuration and bleeding on probing, marginal bone loss > 1/3 implant length) for each of four implants and gingival overgrowth around maxillar implants. While removing the prosthetic abutments, one implant was lost. Peri-implant therapy included debridement of implant surfaces using titanium curettes combined with systemic antibiotics and chlorhexidine. Gingival contouring was performed using Diode laser before prosthetic rehabilitation. Oral hygiene instructions were given to the patient and peri-implant clinical parameters were recorded at 1<sup>st</sup>, 3<sup>th</sup>, 6<sup>th</sup> and 12<sup>th</sup> months. Four months after healing of peri-implant tissues prosthetic rehabilitation was completed.

**Results** There was no bleeding on probing and supuration. Radiological bone fill around implants were seen and PPD was 4 mm. During the follow periods, these results were maintained and patient had no complaints about the prosthetic reability.

**Conclusions** Maintaining a healthy peri-implant tissue is much more difficult than placing an implant. This case report indicates that non-surgical approach with systemic antibiotics and chlorhexidine oral rinses are highly effective for treatment of peri-implantitis. There should be kept in mind that proper prosthetic rehabilitation and supportive periodontal treatment including oral hygiene motivation and regular dental visits are essential for maintaining healthy peri-implant tissues.